Skin Surgery

By

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TO THE SPIRIT OF CO-OPERATION
THAT OUTSTANDING CHARACTERISTIC
OF MEDICAL PRACTICE THAT MADE
THIS BOOK POSSIBLE

Preface

Some twenty years ago I reported to a hospital to commence a residency in dermatology. My first assignment was to perform skin surgery. That first afternoon a seemingly never ending train of patients filed by with moles, cancers, warts, etc., and I removed them with instruments that I never saw before.

There was no one to teach the use of curet or electrodesiccator. There was no book in which one could study the technique of cautery excision. A rotating internship had given some knowledge in cold steel surgery—but dermatologic surgery was a mystery. And there was no place to turn for help. Two years and several thousand cases later I had a fair self-taught by experience skill in some of the procedures to be discussed in this book.

How important is surgery in dermatology? Using the broad interpretation to include all of the techniques presented herein over 70 per cent of the patients seen in private practice could be treated surgically. While the number of individual entities is small, many of the conditions are very common as exemplified by warts, moles, sebaceous cysts, epithelioma, etc.

Yet, often this phase of the subject is neglected in dermatologic training. More thought and time is given to histopathology, mycology, psychiatry, allergy, etc., than to the practical phases of surgery of skin lesions. For instance, at the 1961 meeting of the American Academy of Dermatology and Syphilology, a training meeting, 157 speakers were listed in the program. Yet only two papers were given, one on chemosurgery and one on dermal abrasion, that could be considered to be of a surgical nature.

It is doubtful if dermatologic surgery is so simple that one need not discuss or teach it. The ability to eradicate cutaneous malignancies and to get a good cosmetic result in benign neoplasms are two of the most important functions of the complete dermatologist.

Furthermore, the dermatologists have been berated because their patients never die and never get well. The dermatologists themselves have bemoaned the fact that so many of their patients have conditions that can not be cured simply. They point out that the surgeon can remove his problem by recourse to the operating table. Knowledge of the methods described in this book would allow the dermatologist to do the same in one patient out of five.

Many of the conditions listed in this book as being amenable to surgical approaches may be treated also in a satisfactory manner by other methods. This is particularly true of radiation in epitheliomas, verrucae, hemangiomas, etc. Certainly it is not the purpose of this volume to decry the use of other modalities. The dermatologist comes home at night complaining to his wife of weariness brought on by standing over a hot x-ray machine all day. There is no point in engaging in a debate over the relative merits of these two approaches. However, while often x-ray gives a better immed-

late cosmetic result. It must be remembered that surgical scars improve with time while radiation sequelæ become more marked. A surgical scar is not a threat to limb or life. One can not say as much for a radiodermatitis.

In the treatment of many of these conditions familiarity with conventional methods of excision, closure and grafting gives the surgeon or the operating general practitioner an advantage over the dermatologist. Yet, surgery of the skin is simple as well as important. More attention should be given to training the fledgling dermatologist in the art of excising and suturing even if it means a decrease in the time allotted to other branches of the field. Training centers must realize their responsibility in the training of *practicing* dermatologists.

Surgical treatment leaves its mark on the patient's skin unto the grave. As stated previously, cosmetic considerations are of prime importance in *dermatology. Most lesions treated are benign and even most of the malig*nant ones are easy to cure. Most occur on the exposed parts of the body. Therefore we must not only cure our patients but we must accomplish this with a method that leaves as nearly a normal appearance as possible. This is therapeutic perspective as applied to surgery of the skin. Therefore it is hoped that the dermatologist of the future will be a better surgeon than his predecessors, both for his sake and for that of his patients.

The patient's evaluation of his physician's worth is often measured by the lack of disfiguring scar tissue following an operative procedure. He is not in a position to judge whether a doctor has saved his life by radical removal of a melanoma or epithelioma, he can appreciate only the magnitude of the scar. Obviously it is important to cure the patient, but it is also important to satisfy him with a satisfactory cosmetic result.

What are the contra-indications to surgical treatment of dermatoses? An absolute contra-indication exists in those conditions such as psoriasis, atopic dermatitis, etc., in which surgical treatment can not be beneficial. Secondly, there is a relative contra-indication in that the individual dermatologist should not attempt more than his training, knowledge and skill will allow him to do with a reasonable expectation of success. Above all he should not do the patient harm by performing procedures that he is not equipped to perform by temperament or ability. Each case must be individualized. The dermatologist should use the applicable method with which he is most familiar in each given case. If a patient requires a surgical procedure that the physician is incapable of doing, he should refer the patient to a consultant to perform the operation in question. The good of the patient must come first.

However, none of the procedures mentioned in this book, except the surgical treatment of advanced mucocutaneous malignancies and reconstructive surgery, is difficult. With study and practice any individual should be able to perform these procedures satisfactorily even without formal surgical training. But it must be reiterated that familiarity and knowledge are necessary in the surgical approach to dermatologic disorders.

The statements made in the following chapters are those of the individual authors. The manuscripts were not edited to make them conform to the beliefs of the editor. There is some overlapping of material and

differences of opinion expressed. This is unavoidable since there is more than one way to skin a cat. In other words, a basal cell epithelioma can be eliminated surgically, electrosurgically or by chemosurgery. The confusion could be compounded by pointing out that radiation therapy can do the same thing. It is not surprising that experts in various approaches feel that their own method is the best. It is up to the reader to form his own judgment from the claims and counter-claims of experts in the use of the various modalities.

Thanks are due obviously to the contributors who made this book possible. In addition the assistance of the publishers, Lea & Febiger, is gratefully acknowledged.

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Skin Surgery

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Why Dermatologic Surgery?

Marion B. Sulzberger, M.D. and Victor H. Witten, M.D.

The heading of this chapter expresses a question which will inevitably arise in the minds of many physicians and even more laymen when they meet the present textbook.

That this question should arise is, we believe, a consequence of the manner in which the specialties in medicine and surgery are today constituted and subdivided.

For it is an inescapable fact that the present divisions into specialties and subspecialties and the area which any single specialty should encompass, follow no uniform or logical definition or boundaries beyond those of expediency, practicality and economy. The lack of uniform medical criteria as the basis for constituting and delimiting the specialties makes it inevitable *that the distressed patient will often be baffled as to which kind* of specialist he should turn to for diagnosis or relief and also that even the most experienced physician will sometimes be in a quandry as to exactly which specialty he should select as the one most likely to succeed in the case of a patient having a given complaint.

The unavoidable overlapping between the specialties and the lack of precision as to the lines where one specialty must stop and another begin become most clear when one thinks of the specific examples showing the utterly non-homogeneous manner in which the principal medical and surgical specialties are determined and defined. One of the largest groups of specialties comprises those which one can classify as *organ-specialties*, *i.e.* those specialties which are defined by the *organ principally affected* (*e.g.* cardiology, dermatology, gastroenterology, ophthalmology, otolaryngology); a second group is that of the specialties defined by the *modalities employed* (*e.g.* radiology, surgery); a third group depends for its boundaries upon the *age* of the patient (pediatrics, geriatrics); a fourth category includes specialties determined by the *manner of acquisition of* the diseases (venereology, industrial medicine); a fifth embraces specialties dealing with only certain *kinds of lesions* (oncology, hematology); a sixth group depends for its constitution upon the mechanisms involved (*e.g.* allergy, endocrinology, etc.) and so forth.

In this Tower of Babel of definitions among the specialties it is not to be wondered that often there should be honest doubt and confusion as to where

a given case belongs, or as to precisely which specialty should carry out a given procedure. For example: Who should treat the child with an allergic skin disease requiring radiation therapy?—the pediatrician? the allergist? the dermatologist? the radiologist?—or: Who should treat the old man who presents a skin tumor which requires either radiation or surgery?—the gerontologist? the dermatologist? the oncologist? the roentgenologist? the general surgeon?

The answers to these questions are in one sense quite simple and yet in other ways most complex. Their simplicity lies in the following obvious fundamental and overriding answer: Each patient should of course go or be sent to precisely where he has the best chances of receiving the correct diagnosis and adequate therapy *in the most expeditious and economical* manner and with the least risk of damaging sequelae. It was precisely in order to best fulfill these requirements that the specialties and subspecialties sprang up—when it was realized that no one human being or one physician could possibly acquire and retain the vastness of knowledge, call on the reservoirs of infinitely varied experience, master the almost inexhaustible variety of technical skills and possess all of the diversified apparatus which the sum of the different groups of diseases demanded.

The vexing complexity of the answer as to where the individual patient with the particular complaint should go or be referred lies principally in the difficulty of knowing or ascertaining just which specialist will be the one best suited to give adequate diagnosis and correct treatment to that precise case.

Not only will this question sometimes be difficult to solve in theory and on its purely medical merits, but the answer will necessarily vary according to many variable practical and non-medical circumstances—*e.g.*, is the appropriate specialist nearby or far away? is he too busy? or too expensive for the given patient to afford the lengthy and costly procedures which will sometimes be required? Is the referring non-specialist physician by inclination and background particularly capable in the specialistic field applicable to the case in question? Is a particular one of the different types of specialists to whom the patient might conceivably be sent for some personal reason especially suited to handle the given situation? These are but a few of the many practical considerations which must always be weighed and it is precisely the practical factors which sometimes render baffling and complex even the most experienced physician's selection of the specialist to whom to refer a given patient or complaints of a particular category.

In the light of all the foregoing our original question, Why Dermatologic Surgery? can now be paraphrased and modified in the following two ways:—Why should this patient with a given dermatologic complaint possibly requiring surgery be sent to a dermatologist at all, rather than directly to a surgeon? Or: Why should dermatologists learn or practice any surgery whatsoever if competent surgeons are available?

We believe that in the correct answers to these questions one will find the very good reasons and complete justification not only for the publication of the present textbook but for the continued teaching and practice of dermatologic surgery as an integral part of dermatology.

The following are three of the principal answers

1 Dermatology just like every other organ-specialty must include in its armamentarium all the known *modalities of diagnosis, prevention and management* if its practitioners are to deliver the optimal treatment to those suffering from diseases or disabilities of the particular organ concerned.

Thus a specialist in skin while by no means necessarily a fully qualified general surgeon or internist, must to the degree required by his specialty obviously be something of both and of all other specialties as well For the dermatologist must be prepared to apply to his patients every available modern method of medicine and surgery *as adapted and modified to fit* the problems peculiar to his special organ and its specialized structures, functions and lesions. In addition each organ-specialty will develop and possess special methods and equipment expressly designed for its specific problems (*e.g* the cataract knife, opthalmoscope and slit lamp of the opthalmologist the otoscope the tuning fork and sound-proof rooms of the otologist the Wood's light mycologic culture media grenz rays, patch tests, electrolysis, carbon dioxide snow rotary biopsy punches, etc of the dermatologist)

It is therefore just as illogical to delete dermatologic surgery from the armamentarium of the dermatologist as it would be to deprive him of internal or local medicaments—or to omit from the armamentarium for example of otolaryngology or proctology or any organ-specialty—its surgical procedures or its internal or local medicaments.

2 Dermatology like every other organ-specialty must be that branch best equipped and possessing every known means for establishing the *diagnosis or classification* of all the *diseases and disabilities affecting* the special organ concerned Included in the armamentarium for establishing diagnosis are not only clinical knowledge and experience but also such diagnostic surgical procedures as excisions, biopsies, puncture and drainage obtaining scrapings, etc

In reference to the establishment of the dermatologic diagnosis two facts should be so obvious that it is regrettable that they need be stated at all The first is that the dermatologist is obviously the specialist best qualified by training and experience to establish the *diagnosis of a skin lesion for* he is the only one who has been trained and is experienced in *all* the applicable approaches, both clinical and laboratory the second obvious fact is that until the clinical diagnosis or classification has been established with the utmost possible precision all laboratory and nondermatologic investigations all blind therapy are more likely to prove uneconomical misdirected and fallacious, not to say useless or even dangerous.

And as every physician knows, dermatologic clinical diagnosis is an art which requires a very special kind of skill and experience For the skin of man is prone to an almost infinite variety of changes, many of which can so closely resemble each other as to confuse the non-specialist and yet be clearly distinguishable clinically to *the trained and practiced dermatologist*

When these facts are disregarded and either surgical or non-surgical methods are applied to an undiagnosed lesion in the clinical dark, dire things can and sometimes do happen An itching eruption may be treated

for years with radiation or diets or "shots" or psychotherapy when it is really due to an allergy to a drug or clothing etc or to a liver disease a blood dyscrasia or a cancer of a viscus warts may be removed when they are really the lesions of acanthosis nigricans, often an external sign of internal carcinoma verrucous nevi may be treated painfull and period ically and perpetually with podophyllin under the impression that they are condylomata acuminata a keratoacanthoma or even a molluscum contagiosum may be widely excised under the notion that it is a cancer and a penis may be amputated because of a syphilitic chancre misdiagnosed as a malignant tumor Unfortunately examples such as those just listed are not purely imaginary cases but they and many similar ones are matters of record

So it may be said without equivocation or hesitancy that whenever possible the clinical dermatologic diagnosis or at least the correct dermatologic classification should be established with as much accuracy as possible as early as possible and generally before any other diagnostic or therapeutic procedure is applied As a rule it is only after one has gone a far as feasible in clinical differentiation that one can really tell which further diagnostic and therapeutic procedures are indicated and should be instituted The foregoing does not b any means intend to imply that an accurate clinical diagnosis can be made by the dermatologist on gross morph logic grounds alone in every instance Certainly other investiga tions test biopsies etc must frequentl be called upon in the attempt to establish the diagnosis. But what physician other than the dermatologist hould be expected to recognize the clinical pictures of such benign lesion a molluscum c ntagiosum keratoacanthoma adenoma sebaceum hydrocystoma ringoma leiomyoma epithelioma adenoides cysticum solitary urticaria pigmentosa for example and be able to distinguish them from other sometimes apparently bafflingly imilar lesions? Or to be able to differentiate by their clinical characteristics such cancers, potential ancers and precancers a senile kerat ses arsenical keratoses, Bowen disease Paget disease and erythroplasia of Queyrat from the non-malignant lesion f psoriasis lichen planus eczema seborrheic keratoses distinctiv exudati liscoid and lichenoid chronic dermat si and numer ous others which sometimes can so closely resemble them And again who but the dermat logist hould be expected t differentiat clinically the many f rms f non-pigmented and benign pigmented nevi both from each other and particul rly from the ften imilar-appearing malignant or premalignant kin lesion And to whom h uld one turn if not the kin pecialist not onl f r the clinical appraisal but als for the selection performance reading and interpretation of ppropriate kin tests, kin mycologic ba teriologic and ther lab rat ry procedures, including skin biopsies a l th minutiae f the highl pecialized microsc pic differentia tions N lo r lab rat ry pecialist ther than the dermat logist could by a tretch f the imagination be held apable f u ing or even being familiar ith ll these ery numerous d very pecialized diagnosti and therapeut pproaches

Certainl th entrated combined harpl f u sed knowledge a d experience is f l ulable benefit t the patient I s ving him the time

trouble energy and expense of visits to several physicians and guaranteeing him a carefully selected individually fitted, objective approach in the place of the necessarily limited perforce somewhat narrowed approach of the specialties confined to certain modalities like surgery or radiology

3 Dermatology like every organ-specialty must be and remain that branch best equipped and possessing every known means for *treating* all the diseases and disabilities of the special organ concerned Only in this way can the dermatologic patients receive *selected* expert care be saved the agonies of procrastination and ping ponging from doctor to doctor Were dermatologists to perform no surgery whatsoever in their offices many a very minor rapid and inexpensive office procedure like taking off a wart a mole a keratosis or a small epithelioma, would necessitate several trips to doctors, perhaps to a hospital and certainly entail unnecessary delays, increased anguish and added expense in time and money —and in some instances unnecessarily great disfigurement

The mean from which the skin specialist must be able to select the most appropriate treatment for each lesion or case are of course infinitely varied For they include most of the modalities found useful in other branches of medicine and surgery as well as specially designed "special purpose procedures not generall useful in the other branches. Among the special surgical procedures are very many which are the daily practice of the dermatologist but are so commonly restricted to dermatologic use that most general surgeons would not be either trained or inclined to employ them.

It is of course impossible in this short chapter to tabulate all the various surgical methods that may be used in the treatment of each of the innumeral le kinds of lesions affecting the human skin. Taking just one kind as an illustrative, simple example one may consider a very common skin lesion which usually requires either some form of destruction or removal or no treatment at all The common hairy pigmented smooth intradermal nevus occurs by the billions in the human skin. Any attempt to destroy or remove them all would keep all the world s surgeons and all the world dermatologists busy most of their lives and keep them away from the patient reall requiring their special skills. For such lesions can be found in any part of the human skin and individual patients can have one or a few up to many hundreds. Experience has shown that most can be left alone However if they are to be removed for cosmetic or other reasons, this can be safely done by many different forms of therapy most of which are not commonly used by general surgeons. The method selected will depend on the location size shape degree of hairiness and pigmentation the age occupation and responsibilities of the patient and such non-medical factors as time and expense Bearing these factors in mind any one or a combination of the following forms of therapy are among those which a skin specialist may select to use on such a lesion galvanic or high frequency electrolysis of the individual hairs multiple transfixation of the base with the electrolysis needle using galvanic current solid carbon dioxide applied with measured pressure on the surface trichloracetic acid or other selected escharotics applied topically electrodesiccation alone

electrodesiccation and curettage, scalpel ablation which may or may not be followed by electrodesiccation, and surgical excision.

Another good example is that of one of the most common of all human cancers, namely the basal cell epithelioma. This too may be treated by any one of a number of methods which are in their complete roster generally familiar and available only to the dermatologist. The method he selects will again depend on certain circumstances such as location, size, history of previous therapy for the same lesion, history of previous x-radiation to the area, etc. Among the successful dermatologic office methods of treatment for such lesions are the following: the Sherwell technique utilizing acid nitrate of mercury, the chemosurgical method of Mohs, electrodesiccation and thorough deep curettage, certain radioactive isotopes, radium, x-ray, high frequency cutting current, and scalpel excision with primary closure.

In summarizing our above outlined answers to the Question "Why Dermatologic Surgery?" it can be said that it is an incontrovertible fact that in order to best serve all its patients and the advance of medicine, Dermatology, like every other organ specialty, must include and be able to choose in eclectic fashion from all the known methods and modalities of every existing school, discipline and specialty—in addition to possessing and developing particular methods of its own. All the various methods of surgery used by dermatologists (including some used in common with other branches), especially those peculiar to dermatology because they were specifically adapted or designed for the surgical management of cutaneous diseases, constitute what can be described as "Dermatologic Surgery."

For the reasons described above, as well as for many others equally compelling, these forms of surgery must and will remain an integral part of the teaching, investigation and practice of Dermatology.

While the preceding conclusion is entirely clear, some very knotty questions still remain to be answered. There are, for example, such questions as: How much surgery should the Dermatologist do? How far should he go? When should he call a halt and say, "Enough—this is not for me but for a general surgeon or other specialist"? Of course the answers to such questions are certain to vary from time to time, place to place, from individual to individual dermatologist. But we believe that the vast majority of dermatologists will unhesitatingly agree that except in an emergency or when other special circumstances obtain, the average dermatologist should not undertake surgical operations that require one or more of the following:

(1) Absolutely sterile, aseptic operating room techniques, equipment and facilities.

(2) Prolonged operating time, encompassing hours, instead of just minutes.

(3) Prolonged general anesthesia.

(4) Periods of pre-operative and/or post-operative hospitalization including highly specialized complicated systemic surgical and/or medical preparation and care.

Beyond these four generally accepted contraindications different dermatologists will vary greatly as to what they will choose to undertake in the way of surgery. And rightly so provided each dermatologist undertakes only those procedures in which he is as fully qualified by skill and experience as any other available physician or surgeon.

How much surgery should be done by the particular dermatologist will therefore depend greatly on his knowledge, abilities, training and personal inclinations. For certainly there are some who are more dextrous with the fingers while others though clumsy with the fingers are more agile with the mind—and therefore more medically than surgically inclined.

And there are many practical considerations and not purely medical factors which may influence the surgical practices of the dermatologist. To cite just one such practical circumstance. If there are good surgeons in his vicinity or if he is a member of a group form of practice or if associated or sharing offices with a surgeon it would be quite likely that the dermatologist would depend upon his surgical colleagues for more surgical procedures than if no good surgeons were available in the community or in a radius of many miles.

Dermatologic surgery is usually an office procedure carried out in clean but not completely "aseptic" fashion. The dermatologist's surgical procedures do not require absolute asepsis for the following good reasons.

(1) Asepsis of the skin is absolutely impossible. The skin organ is always inhabited and "infected" by a large variety of pathogenic, facultatively pathogenic and a-pathogenic microorganisms—bacteria, fungi, virus—and can never be completely sterilized. Even the most modern techniques, including antibiotic applications, do not succeed in killing or getting rid of all the germs in the follicles, folds and crypts.

(2) Partial asepsis of the skin as with modern antibiotics, may lead to disadvantageous upset in the ecological relationships—and bring with it the danger of overwhelming growth of some facultative pathogens like monilia, which have previously been held in check by other competitive microorganisms.

(3) The skin is accustomed to being "infected" and can marshal marvelous, natural self-sterilizing forces. The majority of available artificial procedures for skin sterilization may do more harm than good by interfering with the self sterilizing function: through removal of the naturally antibacterial and antifungal surface film; through interference with the propitious dryness and desquamation of the horny surface; through damage to sweat—and sebaceous organs; through maceration; through changes in pH and buffer systems, etc.

(4) Many thousands of observations and many years of experience have shown that the above theoretical considerations are correct—the wounds from most dermatologic surgery heal just as quickly and as well and just as often by "primary intention" when only gentle cleansing of the skin surface is used (of course together with sterility of instruments and washing of the operator's hands), as when full aseptic techniques are employed. The application of potentially sensitizing or irritating local antiseptics is certainly an added risk not indicated but perhaps even contraindicated in most instances. For these antiseptics may not only deleteriously shift quantitative relationships of the normal flora, but damage the self-sterilizing powers of the skin by producing irritation and sensitization dermatitis.

So that it is not through ignorance or carelessness but by scientific choice and with the support of vast favorable experience that most of dermatologic surgery is now carried out with "sparkling cleanliness" but without complex "scrub-up asepsis."

Because of many such medical and non-medical practical factors which will tremendously influence each individual dermatologist's extent and kind of employment of surgical procedures, it is not possible to give an accurate estimate of the quantitative ratio between surgical and non-surgical work in the specialty as a whole. However, perhaps the following figures derived from our clinic will give at least an approximate idea of the role of surgical methods in dermatology.

At the Skin and Cancer Unit of University Hospital, New York University Bellevue Medical Center, one or more dermato-surgical techniques were employed on the patients in 9.5 per cent of all the admissions for the years 1953 and 1954. These included biopsies, excisions, electrodesiccation and curettage, electrocoagulations, incision and drainage, acne planing, electrolysis, cryotherapy with carbon dioxide snow and other minor surgical procedures. It is our guess that the New York Skin and Cancer Unit figures give a reasonably accurate approximation of the average or usual proportion of surgery done by most dermatologic clinics throughout the nation.

We have in this introductory chapter tried to present some thoughts on the scope and nature, the *Why* and the *Wherefore* of *Dermatologic Surgery*. The following chapters of this text will contain the expositions of selected highly qualified experts on the ways and the means, the *When* and the *How* of modern surgical procedures as applied to the human skin and its myriad and almost inexhaustibly varied lesions.

PART I. COLD STEEL SURGERY

2

General Principles of Skin Surgery

Ervin Epstein, M.D. and Robert S. Pollack, M.D.

ONE basic difference between surgery and other mechanical skills, such as plumbing or auto repair work, is that there is no room for the amateur. Due to the risks involved and the potential damage to be committed, it is doubtful if "Do-It-Yourself Kits" for surgical operations will attain great popularity. While there have been instances of surgery being performed in emergencies by unskilled individuals, this is unusual. The fact that a person possesses an M.D. degree should not give him overconfidence in his ability to cut and sew human tissues.

In medical school and as an interne most physicians have some exposure to surgical technique. This chapter, therefore, is a review or reminder of facts acquired previously.

In the following chapters, the reader may find statements by other authors that are in disagreement with those expressed in this section. This is due to the fact that medicine is not an exact science and there is room for differences of opinion. Furthermore, this is compounded by basic differences in the viewpoints of various specialists. Since dermatologists train dermatologists, and surgeons impart their knowledge to fledgling surgeons, it is not surprising that these differences are perpetuated by succeeding generations of practitioners. In addition, the recommendations made in this chapter are constantly changed and improved as newer and better techniques, instruments, dressings and antiseptics are offered to the medical profession. No method is so perfect that it cannot give way to a better one.

HOSPITAL VERSUS OFFICE.

The first question that must be considered is whether it is better to perform surgery in the office or in the hospital. Many factors enter into this decision. There is no question that more expert help can be obtained in an institution. Antisepsis reaches a higher level than in an office catering to nonsurgical patients as well, many of whom have contagious diseases. Hospitals have more complete equipment. For the surgeon who is at the hospital daily, there is little loss of time.

However, the dermatologist spends most of his time in the office and these advantages are outweighed by convenience. When a patient comes to the office to have a mole, or a cyst or an epithelioma removed, it is very

convenient to both physician and patient to go into an adjoining room and perform the procedure. The patient does not have to worry about impending surgery. The practicing dermatologist keeps the necessary equipment in his office. Sterility, though important in skin surgery, is not as difficult to obtain or as demanding as in visceral operations. In general it is felt that most of the procedures described in this book can be performed satisfactorily in the office. However, the decision in each case must rest on the activities and viewpoint of the operating physician.

Scrubbing

For minor surgical procedures such as these, a three-minute scrub with pHisoHex® is adequate. In fact, the use of soap and water followed by rubbing alcohol leaves little to be desired in this respect. Rubber or plastic gloves, sterilized in an autoclave, decrease further the possibility of wound infection. It should be remembered that the chance of infecting the skin is much less than that of introducing pathogens into a body cavity. However, it would be foolhardy for one to ignore the possibility of such a complication. It may occur and be attended by disastrous events. Electrosurgical procedures are self-sterilizing. The eschar formed by such maneuvers gives protection to the denuded area. The same can be said of most of the special methods described in the final section of this volume.

Pre-operative Medication

For office procedures, it is doubtful if pre-operative medication is necessary or even desirable. It must be stressed that the best time to perform a minor elective procedure is as soon as the patient is seen. This precludes any benefit from comparatively slow-acting sedatives. Furthermore, such agents may cause drowsiness in an ambulatory patient. This may lead to unpleasant sequelae since ambulatory patients may well be driving automobiles when they leave the office. In one personal instance, a sedative administered before the patient left home resulted in a deep prolonged slumber that prevented her from reaching the office. The concept that a barbiturate given before a local anesthetic will prevent reactions has not been borne out by personal experience. However, there may be exceptions to this in cases of drug sensitivity.

Pre-operative medication is necessary in major surgery. In such cases performed in a hospital under general anesthesia, it is wise to leave this form of therapy to the anesthetist who is more experienced in such matters. Furthermore, he knows the synergistic or antagonistic effects of various agents. In general, it is wise to combat vagotonicity by the hypodermic injection of atropine sulfate (0.4 mgm.) or scopolamine hydrochloride in the same dosage. Morphine sulfate (10 to 15 mgm.) or Demerol (100 mgm.) can be given concurrently about one hour prior to surgery. Barbital (such as seconal or nembutal) in doses of 100 mgm. to 180 mgm. may be given also a few hours before these drugs if the procedure is scheduled for late in the morning to allay nervous tension. There is also the possible beneficial effect of such agents in the prevention of cocaine sensitivity reactions to be considered.

ANESTHETICS

In a general way such agents may be divided into local and general anesthetics. The former are more important in the procedures under discussion and may be administered by injection or by spray. Those introduced by spray are of limited usefulness. Ethyl chloride and freon 114 are used for surgical planing. Occasionally ethyl chloride may be employed to open an abscess or as a pre-injection anesthetic. However it is not very effective is inflammable and inhalation may cause some general anesthesia a state to be avoided in the office. In fact during the first stage of anesthesia, dreaming and thrashing may lead to undesired complications if the patient is not restrained.

There are a large number of agents that can be used for local anesthesia by injection. The most commonly used are procaine hydrochloride xylocaine and cyclaine. All are used in strengths of 1 to 2 per cent. Epinephrine hydrochloride (1 100 000) may be added but the amount of vasoconstriction and hemostasis so produced is not great. However it may be of sufficient magnitude to result in gangrene of a digit and therefore its routine use is not recommended.

In the skin all of these agents produce immediate anesthesia. The usual technique is to inject them intradermally and subcutaneously into and around the lesion. Nerve block techniques may be used in the fingers and are particularly good with intra-oral lesions. After a nerve block, one must wait some fifteen minutes to obtain the desired anesthesia.

Of these agents procaine is the least expensive and probably is no more dangerous than the others. It should be remembered that cross-sensitization is not uncommon between members of the -caine group. Reactions vary and when such drugs are used in small amounts and in a 1 per cent strength complications are fortunately of a mild nature. However shortly following injection one may see acute dyspnea with laryngeal stridor convulsive seizures, nausea tachycardia collapse and even death. Dermatoses may occur and range from a mild eruption to an exfoliative dermatitis, or a pemphigus-like or Stevens-Johnsons -simulating eruption. In a severe acute reaction with stridor and convulsions, intravenous sodium pentothal is the only effective antidote. In general however millions of injections of these drugs are given annually with a very low incidence of reactions. A history of previous reaction to local anesthesia should urge the physician to be careful as to the amount and strength of the agent to be used. A larger than usual pre-operative dosage of barbiturates is recommended in patients with a history of previous difficulty with the -caine drugs.

General anesthesias may be of the inhalation type or may be given intravenously. Occasionally the rectal route of administration may be used especially in children. Avertin or pentothal may be given in such a manner. Spinal anesthesia is rarely employed in cutaneous surgery. Inhalation anesthesia is frequently supplemented with the intravenous type. At times, however such agents are used independently. Recommended inhalation anesthetics include cyclopropaine ether and nitrous oxide plus oxygen. Agents such as cyclopropaine are highly inflammable and can not be used with electrosurgical equipment. Furthermore extreme care must

be taken to avoid short-circuits and sparks, and a properly constructed grounding system is imperative.

Sodium pentothal is administered intravenously and produces good anesthesia with fewer post-operative complications including nausea and vomiting. However, it has the disadvantage of causing laryngeal spasm, making tracheal intubation a necessity, especially in working about the head and neck. When supplemented with nitrous oxide and oxygen, very satisfactory anesthesia can be maintained. In situations where deeper relaxation is required, pentothal is used with one of the curare-like drugs. Because it is a respiratory depressant, its use in children under the age of sixteen years is not recommended.

ANTISEPSIS

The skin should be sterilized prior to administering a local anesthetic. From the laboratory standpoint, removal of all bacteria from the skin is difficult and often unsuccessful. From the clinical *in vivo* viewpoint, pre-operative sterilization of the cutaneous surface is simple and effective. From the practical side, complete sterilization is not necessary. There are a large number of agents that can be used. Personal preference varies with different operators and operating rooms.

A cleansing agent, such as soap or a detergent (including pHiso Hex), constitutes an ideal agent to prepare the skin, after which painting with various tinctures or aqueous solutions may be employed. Seventy per cent alcohol is easily available, does not hide the lesion to be attacked and is well tolerated. Quartenary ammonium compounds, including Zephiran, have a widespread acceptance since they seldom cause a dermatitis. They can be used in patients with iodine or mercury sensitivity.

Traditionally, the mercurials have had wide acceptance. Such compounds as merthiolate and metaphen were used often. Recognition that these preparations cause reactions in those with mercurial sensitivities has discouraged and limited their use. The most common complication is an erythematous, edematous or bullous eruption in the area lavaged with the drug. Rarely, though, stomatitis, abdominal cramps, generalized dermatitis, kidney damage and fever may result. Iodine is used less frequently for similar reasons. Dyes are passé also since they stain the linens and camouflage the lesions.

Draping is an added measure that is used to preserve the sterility of the operative field. The use of sterile towels and a drape sheet prevents the operator from contaminating the surgical field and is very helpful in maintaining a sterile technique throughout the procedure.

It is probably true that most warts, moles or cysts can be removed by using alcohol on the skin as the only pre-operative antiseptic. On the other hand, strict asepsis is always desirable and decreases the probability of future complications.

INCISION

We are now ready to consider the surgical attack on the patient. A selection of blades rivaling the number of clubs carried by a tournament golfer is at our disposal. These blades are disposable and can be inter

changed on a single handle However it is more convenient to have a number of handles available so that it is not necessary to switch blades too often The main advantage of the interchangeable feature is that there is no need to sharpen the blades. New ones can be inserted to replace dull ones easily and at low cost.

Numbers 10 and 15 blades are the most valuable in dermatologic work. These are round-bellied scalpels The former is the larger and is excellent for shaving off small and medium-sized neoplasms. The second is smaller and can be employed to excise smaller tumors or to dissect out small cysts. The number 11 blade is excellent for stab incisions such as opening a furuncle Numbers 20 and 21 blades are large major surgery type round bellied blades, that can be used for shaving off or excising larger lesions

The simple elliptical incision is used most commonly It consists of two arciform incision lines meeting at each end It is wise to mark the area with the back of the blade and to make cross hatch marks in the same way prior to the actual cutting This maneuver allows for more accurate approximation of the wound edges when suturing After the incision is completed one end of the ellipse is lifted with a toothed-forcep or an Allis clamp and the entire area is then removed by undercutting In narrow lesions, the incision may point inward so that the two lines meet in the subcutaneous tissue

Undercutting the edges of the wound in cases where a wide margin of skin has been removed is sometimes necessary for closure without undue tension This can be performed best by dissection in the subcutaneous fatty tissue with a blunt pointed scissors or the back end of the scalpel handle In the average small incision mobilization of the wound edges for about 1 cm on each side is sufficient In larger operations Z-plasty may be necessary

A simple excisional technique employed by dermatologists is to shave a benign lesion flush with the skin This is applicable to intradermal elevated nevi and fibromas. The base is then treated with trichloroacetic acid to control bleeding and to produce an eschar This maneuver results in excellent cosmetic results if performed properly

Hemostasis

When one is cut one bleeds. It is necessary to stop this bleeding especially in elective procedures such as surgical trauma. The methods of controlling the flow of blood are numerous and varied However the best method of hemostasis is to isolate the severed vessel and to apply a small hemostat (mosquito) *A firm ligature may then be made secure about the* vessel If the bleeder is large a suture may be placed under the hemostat and tied below it tip. But this requires more care and skill than the other method to be mentioned If there is oozing rather than a definite hemorrhaging vessel this method is not applicable Actual closing of the wound by sutures will control most minor bleeding

Bleeding may be controlled or even prevented by electrosurgical methods. Following scalpel or endothermy excision of a lesion, if a hemostat is placed on the bleeding point and the coagulating current applied a thrombus will form within the vessel Bleeding is stopped in many in-

stances by electrodesiccation of the surface of a wound. If this procedure is extensive, the wound should not be closed since the discharge of burned tissue will prevent healing *per primam*. In electrocautery surgery, bleeding is prevented by the sealing of vessels as the instrument cuts through the tissue. Endothermy excision may be performed with the same freedom from hemorrhage.

Certain chemicals are used to stop bleeding or oozing. These include an epinephrine hydrochloride (1:1 000) pack held against the lesion for several minutes. Certain cauterizing chemicals such as trichloroacetic acid, phenol and silver nitrate will control bleeding by sealing tiny blood vessels. Gelfoam and similar substances may be placed in the wound to promote clot formation.

Pressure bandages consisting of layers of gauze applied with elastic adhesive tape are of value. In fact, pressure with a dry piece of gauze or cotton will control minor hemorrhage in most cases.

If bleeding can not be stopped by these methods, a tourniquet can be placed at the base of an extremity for a limited period of time. In fact it is commonplace to use tourniquets on the fingers, wrists or ankles while performing surgery on the digits. This produces a bloodless field and allows chemical agents to seal the vessel before the tourniquet is removed.

Closing the Wound

The offending lesion having been removed, it is now time to close the wound.

Fine cutting edge inch curved needles are best for use on the skin. A small round ½ inch curved needle is used for subcutaneous sutures.

Suture material may be divided into those that are absorbable and those that are not. The latter are more important in cutaneous surgery. Absorbable sutures are used to approximate the subcutaneous tissue and superficial fascia in operations involving comparatively deeper structures. They do not require removal and are buried beneath the surface of the skin. As a rule, size 000 plain or chromic catgut is used for this purpose.

Of the nonabsorbable sutures, silk is probably the most commonly used and is preferred by most surgeons for work on the skin. It may be buried in non-infected wounds. Size 000 is used most frequently on the skin. Cotton is identical with silk and serves the same purposes. It is less expensive. However, the difference is not great enough to make it the suture of choice. Size 40 is employed commonly.

Nylon has the advantage of being completely inactive and inert. It has the disadvantage of unravelling, a tendency which can be avoided by using multiple knots to hold the sutures. It is excellent in infected wounds and ideal in the mouth. As a routine size 0000 is recommended.

Wires may be used to close wounds also. They have the same advantages and uses as nylon and do not unravel. Like nylon they are difficult to handle. Wire can be used as a continuous subcuticular suture which is removed later. In this way the deeper structures of the wound are supported along with the skin. The usual size is number 34. One major advantage of this material is to be found in the fact that these sutures may be tightened or loosened if necessary.

Metal clips are used on the skin but seldom in minor situations. They are a simple quick way to close a small wound without suturing.

If subcuticular sutures are used one may remove the cutaneous sutures as early as one or two days. It is wise to remove them as soon as possible to avoid suture marks. If there is no tension, as on the cheeks the sutures may be removed in one or two days. *In other areas of the face two to* four days is safer to avoid wound separation. It should be remembered that this complication may result not only from tension but from shaving and from scratching as well.

Adhesive tape "butterflies" should be applied to the wound and a dressing used to cover the area even after the stitches are removed. Obviously this is more important on the face or other situations in which the removal is accomplished a short time after the operation. However as a routine in other parts of the body the sutures are left in place for from seven to ten days. In general the longer period of time is preferred. While suture marks remain longer in such instances, the extra support more than compensates for the marks by an eventual cosmetically more acceptable cicatrix. If the sutures are allowed to remain in the wound longer than ten days, they may cut through the skin and subcutaneous tissue thereby increasing the scarring.

Dressings

There are nearly as many possible post-operative dressings as there are surgeons. Personal preference dictates the favorite of each operator. Only a few of the standard and a few of the newer methods are discussed in this section. There are two basic concepts in regard to dressings which seem reasonable: (1) dressings should be avoided wherever possible to minimize cutaneous irritation from tape and medications and (2) once applied barring unforeseen complications the bandage should not be changed for as long a period of time as possible. This is dictated by discharge (as in cautery surgery) or time for removal of the sutures.

The simplest is the dry dressing which may be applied over a noninfected wound. A liquid antiseptic may be painted on the wound and allowed to dry before the dressing is applied. As a routine a small piece of gauze is placed over the wound and is held in place by adhesive tape. As little tape as possible should be used and the adhesive should not completely cover the gauze. This will minimize maceration due to retained secretions. Flesh-colored tape is becoming more widely used. Scotch tape may be substituted for the conventional adhesive tape. However both *seem equally irritating to the skin*. Pro-Cap adhesive may be less irritating. Elastic adhesive tape (such as Elastoplast) applies greater pressure to the wound giving greater support and hemostasis. Increased mobility of the affected part is also possible with this flexible tape.

A dry dressing may be modified by the application of a cream under the gauze. Antiseptics, fungicides or antibiotics are used in infected or potentially infected wounds. Boric acid ointment or petrolatum gauze may be applied to prevent sticking in discharging wounds such as those following cautery surgery. Healing agents may be used in open wounds that are to heal by granulation tissue.

One way to avoid the use of tape is to paint the wound with collodion. This works well but is difficult to remove. A piece of gauze may be applied to the incision and collodion painted on the edges. This holds the dressing reasonably well. Liquid Duo-Adhesive may be used to anchor a piece of white flannel over the gauze and to the skin. This is squeezed from a tube along the edges of the flannel and adheres to the flannel and to the skin. Elastic sprays, such as Aeroplast, are of particular value on the face. Another type of dressing is the bandage that sticks to itself but not to the skin (Gauzetape). It can be applied to a digit or to an extremity and stays in place well.

In psychopathic patients who tend to manipulate their wounds for gain or because of abnormal quirks, an occlusive dressing may be necessary. This is merely a large, firm bandage held in place by some material such as an elastic adhesive to prevent the patient from interfering with the normal *healing process by inserting fingers, wires, files or other agents into the incision.* In some cases, casts or Unna boots may be required to protect the patient from himself.

MINIMIZING SCARRING

Basically, scarring is a normal result of surgery. If the incision extends deep into the corium, a scar must be anticipated. In most surgical procedures performed on the skin it is necessary to reach a much greater depth than this. Therefore, the problem is not "how to avoid scarring," but rather "how to minimize scarring." Unsightly scarring is caused by separation of the wound, by infection, or by overgrowth of scar tissue as in a hypertrophic scar or in a keloid.

One must minimize the possibility of wound separation and infection by careful and skilled technique. Infection must be avoided. While this complication is unusual in minor surgical procedures performed on the skin, it may occur. It demands scrupulous attention to details of asepsis to reduce the frequency of this complication to a minimum. Proper scrubbing, gloves, drapes, pre- and post-operative antiseptics and the use of oral or parenterally administered antibiotics in potentially infected wounds is indicated. It should be remembered that foreign bodies introduced into wounds at surgery, including incompletely removed sutures and powder, may lead to purulent drainage and wound rupture.

Proper support of the wound is essential. This may be obtained by tense dressings and immobilization of the affected part. Splinting of a digit or extremity may be necessary. The proper selection, use and placing of sutures is important. The sutures should not be removed too soon. Except on the face, a good routine is to leave the sutures in place for at least seven days. On the other hand, they should not be left in the wound too long or they will act as foreign bodies and cut through the tissue. Nonreactive suture material such as nylon or wire or clips tend also to minimize scarring. Subcuticular stitches are valuable in avoiding suture marks.

After the sutures have been removed, butterflies should be applied to the incision line for another week. Adequate dressings are essential. Potentially dermatogenic substances should be avoided as much as possible since a contact dermatitis may lead to wound separation.

Certain individuals, especially Negroes tend to form hypertrophic scars following surgery It should be remembered that any person may develop such an overgrowth in one portion of the body but not in another The chest especially on the breasts and over the sternum is particularly prone to such a complication. Infected and ruptured wounds are apt to develop this complication also

Therefore the prevention of keloids and hypertrophic scars necessitates attention to the factors important in minimizing scarring In known keloid formers certain prophylactic measures may be considered also Post-operative x-ray therapy is helpful when administered as soon as hypertrophic changes are noted Probably this is the most effective preventative at our disposal. The injection of hyaluronidase before x ray therapy may potentiate the effect of the radiation. Hydrocortisone ointment used as a post-operative dressing has seemed effective in some instances in the prevention of this complication.

RECOMMENDED EQUIPMENT

This is discussed in the individual chapters. To perform the various procedures described in the succeeding sections, one must have proper equipment. This brings us back to the advantages of hospital over office surgery However for the man doing much cutaneous surgery investment in equipment will pay for itself many times over in convenience and the ability to perform indicated operations.

In conclusion, considering the thousands of minor surgical operations performed each day with good results, the old triad of "cut well sew well heal well still applies.

3

Scalpel Surgery

Charles S. Lincoln, Jr., M.D. and Ray C. Nordstrom, M.D.

The purpose of this chapter is to present as simply as possible office procedures for minor scalpel surgery done on the skin. All procedures are elective and designed to be performed under local anesthesia by a single operator with no help other than possibly a nurse or office secretary who may be required at times to replenish sponges, suture material or a misplaced instrument.

Scalpel surgery is not necessarily advocated as the best or only method for treating the various lesions presented and equally acceptable modalities are described in other chapters of this book. Cold steel surgery is time consuming and many individuals because of their temperament or inexperience find this method unsuitable. The best procedure is the one in which the operator is most skilled and where comparable end results are obtained.

Office surgery has many disadvantages when compared to hospital surgery. This is compensated for by the reduction in expense and the time saved by the patient as well as the physician. However, it is important that surgical standards be maintained without unduly complicating the process.

The majority of patients who present themselves will be healthy ambulatory individuals. However, a brief history should be taken to reveal the presence of diabetes, tendency toward keloid formation, anesthetic sensitivities or excessive bleeding. A controlled diabetic may be handled as a normal person. The various methods for the control of keloid formation will be discussed later in this chapter. The true hemophiliac will inform you of this condition and presents no problem. However, there is a small group who hemorrhage excessively but cannot be classified as true hemophiliacs. Should such a case be inadvertently operated upon, hospitalization may be required. Anesthetic sensitivities, such as reactions to procaine, may be somewhat overcome by prescribing barbiturates preoperatively or by the use of a chemically unrelated local anesthetic. However, skin testing may be necessary.

In the older age groups factors of nutrition, anemia, chronic infection and internal malignancy may impair wound healing. Vitamin therapy, especially ascorbic acid, with supplemental mineral and protein may occasionally be advisable before simple procedures are undertaken.

General Considerations

It is difficult to do good surgery intermingled with a busy office practice. It is preferable to schedule surgical procedures for one or two mornings or

afternoons a week and during this time make no other appointments. Such a routine has many advantages especially if one is not fortunate enough to have a surgery room. A treatment room can be arranged in a few minutes and only simple and inexpensive equipment is necessary. Better illumination can be obtained by using a 200 or 300 watt globe in the ceiling fixture. If an adjustable table is not available wooden blocks may be placed under each leg of a fixed table thereby raising it to the height found most comfortable to the operator.

Pre-operative sedation of the patient is of importance and will reduce the number of reactions encountered. For the very nervous patient 1 or 2 grains of phenobarbital depending upon the age and size of the patient, may be given at bedtime the night before surgery. Patients are advised to come to the office one-half hour before their scheduled operation at which time the administration of ½ to 1 grain of a more rapidly acting barbiturate such as seconal, nembutal or butisol-sodium (preferably in an elixir for rapid absorption) can be given. For the average patient the office dosage is all that is required to allay his anxieties. Post-operative sedation is of equal importance. Codeine with aspirin or one of the proprietary analgesic compounds, if needed, is excellent.



Figure 1.—Preparation table. 1, Sponge forceps. 2, Tincture of green soap. 3, Tincture of iodine (or metaphen, merthiolate, Zephiran). 4, 70 per cent alcohol. 5, Benzene tape scissors. 6, Cotton balls. 7, Gauze sponges. 8, Cotton applicator sticks for applying antiseptic.

Preparation of Operative Site

When scheduling a patient for surgery he is advised to wash the operative area before reporting to the office and if the scalp is involved the hair should be shampooed and dried. Cosmetics should not be applied before coming to the office.

In surgery the skin should be cleansed gently with tincture of green soap or pHisoHex and then painted with tincture of iodine or zephiran.

It makes little difference which antiseptic is used (metaphen, merthiolate, zephiran, or iodine) but it is important that it be removed with alcohol before the incision. A preparation table or tray (Fig. 1) can be set up for permanent use.

Hairy areas should be clipped and shaved in the vicinity of the lesion. However, eyebrows, particularly of females, should not be shaved. It is unnecessary to shave the entire scalp. In ambulatory patients it is important to preserve as much of the normal appearance as possible, as many will go about their regular duties immediately after surgery.

Following the preparation, local anesthesia should be induced and the field once again wiped with 70 per cent alcohol.



Figure 2. A. Pigmented lesion [illegible] with slight tendency to keloid formation. B. Lesion [illegible] and snipped off with curved scissors. A scalpel [illegible] blade could be used to [illegible] off the growth. C. The following day after [illegible] of pressure bandage. D. T[illegible] after removal lesions are completely [illegible]. There [illegible] very slight thickening of the scar and depigmentation. X-ray [illegible]. The treated area resumed normal pigmentation [illegible] short time.

ANESTHESIA

A few minor operations may be undertaken using refrigeration anesthesia after proper preparation of the skin. The lesion under consideration (Fig 2) is sprayed with ethyl chloride until frozen solid and then shaved off with a razor scalpel or snipped off with curved scissors. Cysts may be marsupialized in this manner and abscesses incised

For the majority of procedures anesthesia is produced by infiltration into or around the operative area with 1 or 2 per cent procaine hydrochloride or 0.5 to 2 per cent lidocaine hydrochloride (xylocaine) both containing epinephrine 1 100 000 Reactions are rare especially with xylocaine Relatively large amounts (20 to 30 cc.) of the anesthetic may be used with safety especially if the patient has been prepared with a barbiturate which seems to give protection against -caine idiosyncrasies. The epinephrine prolongs the anesthesia and produces a less bloody field It is advisable not to use epinephrine when injecting the distal end of a finger or toe and further the anesthetic should not be injected to the point where the entire digit becomes distended and tense This is especially true in the older age group since the vasoconstriction produced by epinephrine and the restriction of circulation due to pressure may cause gangrene A tourniquet such as a rubber band or small pipette rubber tubing will reduce bleeding

The procedure may be simplified by administering the anesthetic after preparing the operative field and scrubbing but before slipping on sterile gloves or opening the sterile tray to drape the patient This eliminates having the anesthetic solution hypodermic needles and sterile syringes on the surgical tray as well as being able to handle the anesthetic bottle needle and syringe without assistance

SURGICAL SETUP

The surgical instruments and supplementary materials needed for minor office surgery are not numerous or expensive However they should be standardized and a duplicate or triplicate set of instruments always available

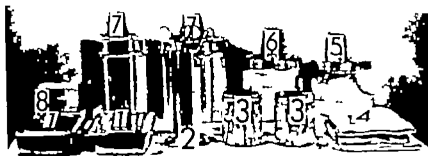


Figure 3 Surgical table 1 Surgical instrument in duplicate Sponge forceps 2 Suture material with atraumatic needles attached 4 Sterile gloves 5 2 × 2" gauze flat 4 × 4 gauze flat Sterile towels 8 Scalpel blades (Nos 11 15 and 20).

3

A permanent surgical table (Fig. 3) should be set up. The surgical instruments may be kept in a cold sterilization solution (zephiran or Barnes-Hines Germicidal Solution), each set in a separate covered tray. After any surgical procedure the instruments should be scrubbed in soap and water, rinsed, boiled for five minutes, dried, and returned to the covered tray containing the cold sterilization solution ready for re-use. The scalpel blades are best kept dry in their folders and placed in the sterilizing solution at least fifteen minutes before surgery is anticipated. Glass jars containing sterile 2 × 2" and 4 × 4" gauze squares and two large containers of sterile towels should be on the surgery table. These materials must be autoclaved. Two pairs of sponge forceps in a container are also needed, along with an *adequate supply of suture material and sterile gloves of the proper size.*

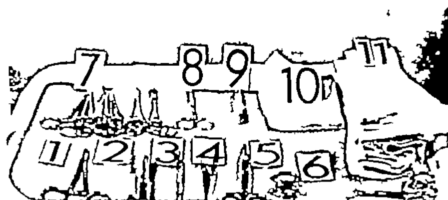


Figure 4.—Operative tray on adjustable Mayo stand. *1* Needle holder. *2* Suture material with attached atraumatic needles. *3* Blade and scalpel. *4* Blunt forceps. *5* 5-inch scissors. *6* Towel clips. *7* Curved and straight mosquito hemostats. *8* Curved scissors. *9* Biopsy punch (optional). *10* 2 × 2 and 4 × 4 gauze flats. *11* Sterile towels.

From the surgical table a complete operative tray (Fig. 4) may be set up in a very few minutes. An opened sterile towel is placed on an adjustable Mayo stand, on which the instruments from one set are arranged with two sterile towels, gauze sponges, and the desired suture material. Assuming the patient has already been prepared and anesthetized but not draped, the surgeon should now slip on sterile gloves, drape the patient with sterile towels, and begin the surgical procedure.

Reparative Technique

Choice of needle and suture material varies with the operator. Two types of needles are available: the round and the cutting. The cutting needle is flattened on two or three sides and is preferred for dermal suturing. The Atraumatic type needle with the suture firmly attached to the shaft avoids pulling a double suture through the tissue. It is superior to the older eye needle and it is the needle of choice. For delicate work where little tension exists, as on the eyelid, the half-circle small cutting needle

is preferred Where skin separation is greater the larger ⅜ circle needle is advisable

The suture material required will vary from 00 which is heavy to 5–0 which is very fine Two types of suture material will be discussed—monofilament nylon and silk. Monofilament nylon does not kink or fray has a great tensile strength is not absorbed and causes a very slight tissue exudation of short duration. However because of its hardness it tends to slip and consequently the knots untie which at times may be advantageous Silk, which is preferred by many does not possess the tensile strength of nylon and therefore must be used one grade heavier However it has less tendency to slip is more pliable and ties easily Two types are available the twisted which tends to kink, and the braided which frays.

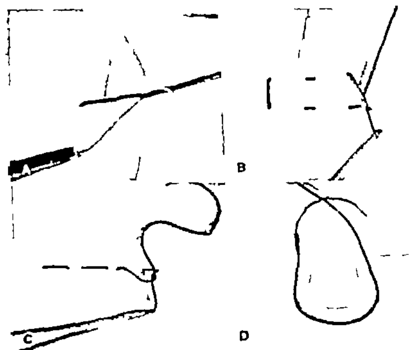


Figure 8.—A Simple interrupted suture B Mattress suture C Vertical mattress suture D Everting suture

In general for the less experienced operator who has not yet developed a set technique the use of monofilament nylon with an Atraumatic* curved cutting needle is recommended

Sutures are of two types tension, which is inserted at a distance from the incision edge to relieve strain and approximating to bring the edges as evenly and closely together as possible

For skin closure the interrupted suture is preferred Although a continuous suture can be applied more rapidly it puckers the skin strangulates the edges and if one segment is ruptured the entire wound may break down.

Knowledge of varied suture techniques is not required The simple interrupted suture (Fig 5 A) is adequate for closures. A wide bite may be taken to relieve tension The mattress suture (Fig 5B) is valuable for closing dead spaces, everting skin edges and may be used primarily as a retention suture The vertical or right angle mattress suture (Fig 5C) combines the virtues of the mattress and also gives an accurate approximation of the skin edges. The latter two sutures tend to constrict tissues. The skin may be everted and dead space closed by placing the skin suture close to the edge of the incision and angling wide and deep (Fig 5D)

Before any suture is placed a certain mastery of knots is necessary Three knots will be described and demonstrated in all cases using an instrument (needle holder) tie

The square (reef flat) knot (Fig 6D) is the best knot to use for most circumstances. It lies flat and will not slip However once it is tied it is difficult to tighten.

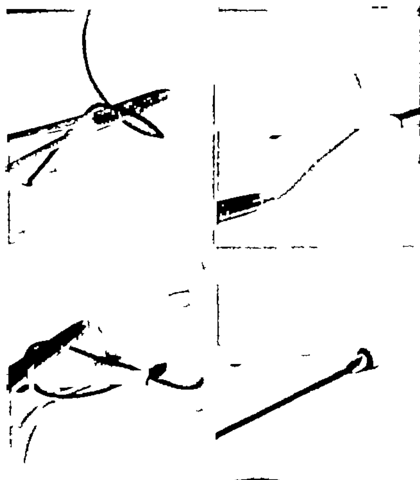


Figure 6 A—D
(Also see next page)

The surgeon's knot is tied in the same manner as the square knot, but the first tie is a double loop (Fig. 6*G*) which tends to hold under tension until the second tie (Fig. 6*H*) can be applied. Obviously the first tie may be held by an assistant with the tip of a hemostat. However all procedures have been designed for a single operator without assistance. The surgeon's knot is more bulky and does not lie as flat as the square knot. Even so it is considered to be a very good knot.

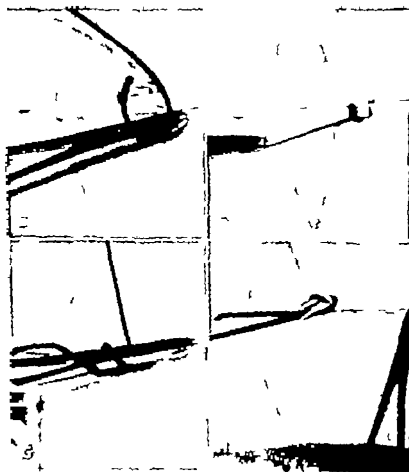


Figure 6.—The various steps in instrument tie. The skin is diagrammatically represented as an open incision to better illustrate the course of the suture in toto. *A* The first step demonstrates the instrument in the right hand and the needle end of the suture in the left. Note the direction in which the suture loops over the needle holder from left to right. *B* A simple knot. *C* The second loop for tying a square knot passes over the instrument in the opposite direction from right to left. *D* A completed square knot. *E* In tying a granny both the first and the second loops are tied in the same direction from left to right. *F* A completed "granny" knot. *G* The surgeon's knot is tied in exactly the same manner as the square knot only the first tie is a double loop from left to right. *H* A completed surgeon's knot.

The "granny" knot (Fig 6*F*) is said to be an unsatisfactory knot. In spite of this it does have its place as its bad quality is its virtue. It slips. Where tension is great and the surgeon's knot will not hold long enough for a tie to be completed a "granny" may be taken and slipped tight. A single or better a double square knot should always top a "granny" even if no tension exists. This technique works exceedingly well with nylon suture material.

The instrument tie has been demonstrated because of the ease with which it can be mastered and the great saving in time and suture material.

INDICATIONS.

To list every lesion amenable to excisional surgery would be encyclopedic. The nevi alone are recorded in various texts as numbering from 30 to 40. In general it may be said that any superficial growth or blemish may be removed by simple excision as an office procedure provided it is in an accessible location and it is possible to approximate the skin edges after excision. Obviously the size of the lesion that can be excised will vary with its location and the age of the patient. On the nose for example because of the limitation of tissue only small lesions possibly up to 1 centimeter are amenable to this approach. On the dorsum of the hand chest abdomen or back, much larger lesions can be excised. The face and neck require special study because of cosmetic considerations. In the older age group after the skin has become wrinkled and lax relatively enormous lesions can be removed by simple excision.

It is our feeling that excisional surgery in most cases is corrective or cosmetic surgery. This fundamental principle is often disregarded in the removal of small malignancies. It is not an uncommon practice to later excise a scar which is the end result of a successfully treated epithelioma removed by electrosurgical or radiological methods. Conversely we have seen disfiguring defects created by surgery where the latter two methods would have given an acceptable cosmetic result.

By far the most frequently encountered skin lesion suited for simple surgical excision is the nevus. Under this group fall most of the congenital defects including moles of all varieties, pigmented and non-pigmented, verrucous, vascular, pigmentary and hairy anomalies. With the exception of the vascular lesions which are best treated by other methods and the very large growths or blemishes simple excision is an excellent approach not only from the standpoint of cosmetic result but for complete removal.

Fibromas are frequently noted connective tissue tumors that may occur in any location on the skin or mucous membrane. Because of their slow growth and benign nature they are observed when relatively small, often pinhead size. Simple excision is curative.

Neurofibromas occur as nodules along the peripheral nerves. These are well circumscribed and slow growing and may be removed by simple excision. A congenital type of neurofibromatosis (von Recklinghausen disease) presents a much more difficult problem. If attacked early with fairly wide deep excision the milder cases may be controlled. However there is a great tendency for these tumors to recur.

Sebaceous cysts are said to undergo malignant degeneration in a small percentage of cases. If this is true certainly excision is the only possible treatment. Remember that beautiful cosmetic results may be obtained by a simple incision and removal of the sac by pressure.

Corns and calluses involving the feet may be excised with complete relief of symptoms after all other methods of correction have failed including arch supports, health shoes and the diligent efforts of a tireless orthopedist or chiropodist. Plantar warts, being a virus infection, are best treated by other methods except in rare instances where excision may be attempted as a last resort.

Keloids present a special problem. At the present time in spite of the steroids and various freezing procedures such as solid carbon dioxide their eradication is difficult. One of the more successful treatment procedures is careful excision of the keloid followed by post-operative irradiation.

Last but not least, most cutaneous malignancies are amenable to excisional surgery. Whenever a suspected malignancy is small enough we feel that the biopsy should be the complete excision. This avoids the necessity of a second procedure.

Excisional Principles.

1. Mark the lesion to be excised with criss-cross markings and/or outline with gentian violet because the lesion may be inconspicuous after infiltration of the anesthetic solution. This is especially true of small and subcutaneous neoplasms.

2. To be certain the anesthesia is complete, test by pricking within and beyond the excision line with the point of the blade for pain response. Question the patient as to actual pain since he may regard pressure as a pain sensation.

3. Make your incision bold, true and firm. Hold the blade at right angles to the skin surface and cut completely through the skin using two elliptical incisions that should join at each end. A sharp blade is an absolute necessity.

4. When possible the incision line should follow the lines of cleavage (Dupuytren or Langer's lines). The connective tissue fibers in the dermis form lines of tension and incisions along these lines do not tend to gape, require fewer sutures and heal with a finer scar. Keloids are less apt to form in such incisions. However, excellent cosmetic results may be obtained by cutting at right angles to the cleavage lines with proper approximation. Such a procedure is permissible if a lesion is so shaped that tissue will be saved and tension reduced by excision across the lines. It is wise to incise parallel to the creases, wrinkles, or folds of skin as again tension is reduced and the scar may be imperceptible.

If function is a factor, as in the antecubital fossa, the incision line should follow the flexion crease and not the cleavage lines which are at right angles.

5. In simple skin surgery it is seldom if ever necessary to burn a suture of any kind, whether it is gut, silk, cotton, nylon or wire. A little patience, the clamping of the larger bleeders for a few minutes, and pressure with a gauze sponge is sufficient to obtain hemostasis. An exception of course would be the accidental severance of a major vessel. When hemorrhage is

excessive a mattress suture (Fig 5B) or a vertical mattress suture (Fig 5C) will close the dead space and constrict the bleeders. When buried sutures are used a certain number will be extruded and a draining sinus will result whereas a blood clot will always organize and be absorbed

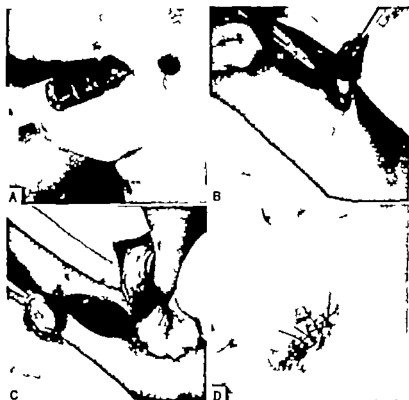


Figure 7 — 1 Deeply pigmented hairy nevus i volving the left side of the n k t the angle of the ja Not the nesthetic is being injected through one punct re A long needle ma be manipulated under the skin eliminati g mult ple cutaneou pun t res bout the growth. B Elliptical incision mad cutting completely through the skin to the f t The mole is being bisected out C Mole completel excised for biopsy Check the ound for deep hair follicles and snip them out if present D I version closed th 5–0 lon On mattress sut re (Fig 5B) used for eversion of the kin edges Thi hould be remo ed t or three d Remove ll but one or t of the approximating sut res in fiv d the remainder in seven d I eek there is l ttle likelihood of ound separation

6 The in ersion of kin edges should always be avoided Careful appr ximation without c nstriction i the secret of good dermal surgery Do not tie the i tures t tight and use imple interrupted stitches wl en possible Th mattres utur i essential f r closing dead spaces and for the control of bleeding H wever because it constrict tissue it should be removed a so n a possible In most area it is best to rem ve the retention or the mattress sutures on the second or third day On the face or

nose the remaining sutures should be removed on the fifth to seventh day. When there is motion, such as the neck, dorsum of the hand, leg, or where tension may be unconsciously or accidentally applied, such as in the mid scapular region, *a few sutures may remain for seven to ten days.* Incisions

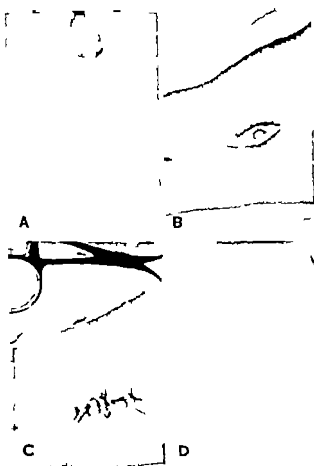


Figure 8.—*A.* Supernumerary nipple in twenty-year-old white girl four months pregnant. *B.* Elliptical incision lines. *C.* Closure made using single vertical mattress (Fig. 5C) for retention and interrupted sutures. This was removed on the second day and the approximating sutures on the fifth day. A butterfly bandage was applied as precaution against wound separation. *D.* One week after excision.

involving the toe or sole may require ten days for sufficient healing before sutures are removed. The removal of stitches before this period would probably result in wound eruption.

Without a doubt, wound separation is the most embarrassing of all surgical accidents. The use of a butterfly bandage after all sutures have been removed is a further precaution against this complication. This

should be done routinely on the face where it is important to remove sutures early

Procedures

The technique for removing the following lesions is almost identical with only slight variations for size, shape, location and depth of the lesion in question.



Figure 9 — [illegible] the scalp *B* Elliptical incisions *C* [illegible] being dissected [illegible] hemostat between [illegible] *D* [illegible] removed [illegible] *E* Sutures [illegible] place *F* T[illegible] of excision.

Most nevi that have been present for years, unless very deeply pigmented flat, or rapidly growing may be excised elliptically the incision line extending relatively close to the edges of the lesion in question. If the growth is hairy (Fig 7) and pigmented excision is the best approach Although such tumors are seldom malignant the nevus cells extend below the surface and any other form of removal may result in a pigmented hairy remnant or a depressed scar To show the wide applicability of this technique a supernumerary nipple (Fig 8) has been excised for demonstration purposes.

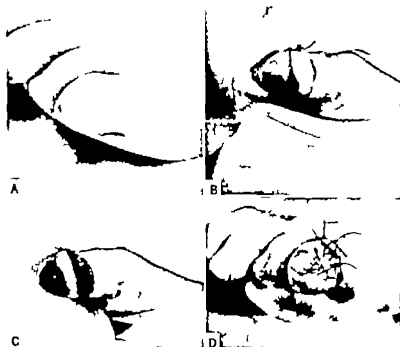


Figure 10. — A Corn left little toe B Incision line. C Corn excised. D Sutures in place.

A suspected melanoma must be widely and deeply excised for biopsy studies and sutures taken Should the clinical diagnosis of melanoma prove incorrect cure has been achieved Otherwise further indicated surgery can be performed Biopsy studies from this excised specimen will reveal the correct diagnosis and extent of the lesion

Sebaceous cysts are common and may be located on practically any area of the body These cysts are amenable to surgical excision. By making an elliptical incision over a sebaceous cyst (Fig 9) the excess skin may be removed The best results are obtained by not cutting or breaking the cyst wall. Following incision a curved or straight mosquito forceps

is placed against the outside of the cyst wall and repeatedly spread apart This separates the cyst from the surrounding tissue The knife handle or the blunt end of the blade may be used in a similar manner When it is possible to slip the finger completely around the cyst wall it may be extracted with forceps and separated from its base using a sharp blade Disregard the bleeding which may be marked and proceed with the closure One or two mattress sutures depending on the size of the cyst will result in hemostasis. Healing is excellent particularly on the scalp The mattress suture may be removed in two or three days and the remaining sutures in seven days.

A corn (clavus) (Fig 10) especially on the outer aspect of the little toe is one of the most painful benign skin growths. Excision of such lesions i not advocated as the initial procedure It is advisable to have a roentgenological examination of the entire foot to reveal bony deformities.

The member is best anesthetized by injecting the solution about the proximal end of the toe or a local digital nerve block may be preferred Care should be taken not to inject a quantity that produces a distended and board like toe Because of the unavoidable vasoconstriction due to pressure there is little bleeding with or without epinephrine in the anesthetic The elliptical incision lines (Fig 10B) may pass quite close to the visible and palpable border of the corn The incision should extend around the toe for a sufficient distance to permit closure without puckering this requires a long incision The skin wedge which includes the corn is dissected out and down to the periosteum or joint capsule The skin is undermined both proximally and distally and a single mattress suture using 4-0 nylon or silk is sufficient for retention and eversion of the skin edges. Simple interrupted sutures tied with square knots placed close together for exact approximation are necessary

A pressure bandage is applied about the wound because these patients are ambulatory They are advised to wear or bring a slipper to the office as the street shoe will not fit over the bandage Since the feet cannot be considered an aseptic area a sulfonamide preparation such as sulfisoxazole (Gantrisin) is prescribed in the usual dosage No other particular precautions are necessary except to keep the foot dry Aspirin and codein should be prescribed for post-operative pain

The retention suture should be removed in three or four days, half of the approximating sutures on the sixth or seventh day and the remainder on the tenth or eleventh day

Calluses on the feet (Fig 11) like corns are said to be caused by or at least initiated by improperly fitting shoes foot deformities, or osseous defects. In spite of all attempts to eradicate a painful callus it may persist for years and walking may be extremely painful Again it may be wise to have a roentgenological examination pre-operatively However we have not received one such report from a roentgenologist indicating any type of bone deformity

The incision lines (Fig 11B) should extend just beyond the visible and palpable borders of the callus following exactly the Cruta cutis or skin ridges more commonly called prints. As the skin including the callus is

dissected out an abundance of fat will protrude through the excision space This should be cut away with a pair of curved scissors. The metatarsal phalangeal joint may be probed with the finger for protrusions or spicules which if found should be removed For closure one deep horizontal



Figure 11—1 Plantar callus A insignificant appearing lesion yet this patient requested excision because of years of suffering *B* Incision lines following the skin ridges C Callus completely excised and excess fat cut [illegible] showing open wound. *D* Sutures in place Note one mattress used. *E* Three weeks after excision.

mattress suture using 3–0 nylon or silk will close the dead space, evert the skin edges and produce hemostasis. Simple interrupted sutures should be used for approximation.

A firm pressure bandage covered with elastic adhesive will provide adequate splinting. A sulfonamide preparation may be prescribed to aid perfect healing without infection. Wound separation due to secondary infection sometimes produces a scar that is more sensitive than the original callus. Should a painful scar result, it can be re-excised, avoiding if possible the original error.



Figure 12. A, Tattoo on dorsum of right hand showing incision lines followed. B, Three weeks after surgery. In this location every third suture should be left in place nine or ten days to insure against wound eruption.

On the sole of the foot the retention or mattress suture should be removed on the fifth or sixth day, half of the remaining sutures on the seventh or eighth day, and the remainder of the sutures on the tenth or eleventh day. The thick horny layer on the sole of the foot will appear macerated along the excision line and will exfoliate (Fig. 11B). Do not be alarmed as this is not wound separation.

The removal of one or more fingernails or toenails is a simple surgical procedure. For chronic paronychia or painful inflammatory conditions due to ingrown nail, removal after failure of other procedures is often curative.

An ingrown toenail usually involves the lateral side of the great toe with the nail acting as a foreign body. Due to the chronic pressure irritation and secondary infection a pyogenic granuloma will develop along the nail groove. In such cases it is preferred by many to remove the involved one-third or one-half of the nail rather than all of it. It is essential in such cases to excise the soft granuloma down to healthy tissue and electrodesiccate the base for hemostasis.

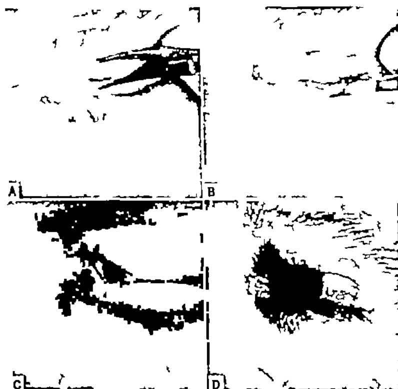


Figure 13.—*A* T xanthelomas left upper eyelid ell elev ted by the infiltration of the loc l anesthetic showing the pl cing of the curved scissors for excision. A scalpel is ery difficult t use in this location. *B* First xanthelioma snipped out. *C* Sutures in place. They may be removed in three or four days. *D* T eeks after surgery

Onychom cosis is one of the most therapeutically difficult conditions to the ph sician a well a being unsightl to the patient. No other method f treatment whether it be x-ray fungicidal medications, ammoniacal il er nitrate scraping or burring or better a combination of all of these will gi a high a cure rate a removal. The cure rate varies between 40 and per cen t depending upon technique

It is essential that a definite diagnosis be established by demon trating the fungu either b scraping or culture Removal will not cure a psoriatic

Figure 11. *A*. Basal cell epithelioma right upper lip. *B*. Incision [illegible] made. Note firm grasp on lip with the thumb and index finger. *C*. D[illegible] [illegible] Do not go through the total mucous membrane. *D*. Lesion completely excised. *E*. First 3-0 silk suture placed through edge of vermilion border of lip. *F*. Note how [illegible] completely closed the wound. *G*. Sutures in place. All but the first [illegible] sutures removed [illegible] the remainder in one week. *H*. T[illegible] weeks after surgery.

nail which may be confused clinically with onychomycosis. No attempt to remove the nail should be made until the skin is free of infection.

The local anesthetic is best introduced about the distal phalanx although a local digital nerve block is preferred by many. The anesthetic solution should not contain epinephrine for vasoconstriction.

The only instruments required are a curved or straight mosquito hemostat, a curette and curved scissors.



Figure 15.—*A*. A clinically typical basal cell epithelioma on the tip of a rhinophymatous nose proved to be a grade I squamous cell epithelioma. A basal cell epithelioma will be noted (white arrow) on the left side of the nose. *B*. Incision lines. Again note firm grasp for a smooth even incision. The cut is at right angles to Langer's lines of tension. *C*. Tumor everted and edges undermined. Note the cartilage exposed. *D*. 4-0 nylon sutures in place. The nose healed rapidly with little scarring. All but two sutures were removed in four days, the remainder in one week.

The forceps is inserted under the cuticle separating it entirely from the nail. The forceps is now inserted under the tip of the nail which is usually partially separated from the nail bed by the infection and the nail elevated. This is repeated in stages until the distal portion of the cuticle has been separated. At this stage the nail may be gently rotated and extracted. The nail bed is thoroughly curetted until the matrix of the nail bed is

reached. Snip off frayed ends with the curved scissors and pack under the cuticle with iodoform or plain gauze. A tight pressure bandage is now applied over the nail bed. Pain may be severe and a prescription for an analgesic drug should be given. Crutches may be necessary.

Redress with a dry dressing in two days. In five or six days there usually is no bleeding and 5 per cent ammoniated mercury ointment may be used on the dressing. The ointment should be used three or four times daily until the nail regrows. After about ten days no bandage is required. Regrowth occurs in three to four months.

Keloids, as has been mentioned, are a surgical enigma. The inexperienced may feel that a keloid may be eradicated by careful excision, close approximation using wire sutures and the use of antibiotics to prevent secondary infection. This has been done but more often than not a larger, more unsightly keloid than the original will result. However, simple excision when combined with post-operative x-ray or radium therapy often gives an excellent result.

Excision should include the principles of the routine previously described. Because of the constriction of the tissue produced by a mattress suture it is best to use simple interrupted sutures. For skin eversion start the suture near the edge of the incision (Fig. 5D) and angle wide and deep. Do not tighten so that constriction is produced. The prescription of a sulfonamide preparation or one of the antibiotics is a wise precaution. The sutures are removed depending on location as previously described.

X-ray therapy may be given to the excised area the week before surgery, immediately following excision and suturing, and a few days after the sutures have been removed. If there is no indication of keloid development within two weeks it is unlikely that a keloid will form. However, at the first sign of recurrence additional irradiation therapy should be given.

As has been mentioned previously, certain small macular lesions such as pigmented patches, mongolian spots, blue nevi, linear and hairy lesions, etc., are amenable to surgical excision. A self-inflicted disfigurement, the tattoo (Fig. 1[illegible]), is best removed by excision. When it is realized that the pigment is deep, often in the fat, any abrasive method such as planing, sandpaper, caustics, etc., will destroy sufficient adenexal structures to result in a tissue paper or hypertrophic type of scar. Re-tattooing with a neutral pigment is an excellent approach but only a few individuals use this modality.

Xanthela may only be cut out with curved scissors and sutured.

The last group of lesions to be discussed are the cutaneous malignancies. The smaller lesions of this type are easily excised. The excision should remove the lesion *in toto* and healing is usually complete in one to two weeks. After total excision an adequate specimen is examined by the pathologist to determine its nature and extent. If properly excised with a liberal border of normal tissue about the tumor, the microscope and time will reveal a complete cure.

The technique for excision of malignancies varies little from benign lesions. The basal cell epithelioma is most frequently encountered about the face and scalp and the superficial type on the trunk. A certain percentage of these lesions, approximately [illegible] per cent, are the basosquamous

or transitional cell type Clinically they cannot be distinguished from the pure basal cell epithelioma and are treated in the same manner Classically the basal cell epithelioma will be noted on the face and early appears as a hard waxy nodule with a rolled border and central depression Early crusting and ulceration is common

With experience these lesions are so easily recognized that a biopsy previous to total excision is unnecessary A good rule is to excise with a margin on each side equal to one-half the diameter of the lesion.

To demonstrate the principles of excision an unusual basal cell epithelioma involving the upper lip (Fig 14) has been excised The incision is wide and deep but not through the mucosa Malignant lesions involving the mucous membrane of the lower lip that are surgically removed by a "V" excision must include the mucosa and extend through the entire lip This procedure entails more radical surgery and more skill

Leaving the mucous membrane of the upper lip intact protects the excision to a certain extent from contamination maintains continuity and avoids excessive hemorrhage into the mouth and throat. The patients who develop these lesions are frequently edentulous and it is wise to leave the dentures in place during surgery They maintain the shape of the mouth which is important in closure. The initial suture is placed (Fig. 14) deep and through the vermilion margin of the lip and the edges pulled together for exact approximation. Do not penetrate the buccal mucosa although no harm will result if this is inadvertently done. Deep-wide angling interrupted sutures (Fig 5D) are preferred although one or two mattress sutures for eversion are permissible

Healing is rapid about the mouth Consequently all but a few of the sutures should be removed on the fourth or fifth day and the remaining on the seventh day

The squamous cell epithelioma (Fig 15) may be clinically identical with a basal cell epithelioma but usually these tumors have a more warty appearance Frequently a squamous cell epithelioma is preceded by a senile keratosis of several years duration the malignancy developing at the base of the keratosis. In certain locations such as the dorsa of the hands, arms, ears penis, scrotum, vulva and of course the lower lip a squamous cell epithelioma may be suspected This is especially true of fair-skinned blue eyed individuals living in sunny climates. Unlike the basal cell which almost never metastasizes, the squamous cell and the baso-squamous cell may develop widespread metastases. Metastasis is usually late even on the lower lip and these lesions give many years of warning The large neglected ulcerated and fungating neoplasms with the likelihood of metastases to the regional nodes are not in the scope of this chapter

A neatly applied dressing should be the topping for a well done operation. Often excellent surgery is, at least temporarily maligned by a sloppy ill-fitting bandage The use of flesh-colored tape trimmed round on the corners and applied with firm pressure will be appreciated by your patient The underlying gauze pad should be as small as possible and yet cover the entire wound Pressure by the use of elastic adhesive tape will reduce post-operative hemorrhage to a minimum

On the face and scalp, if the patient is agreeable, no bandage is necessary. Conversely, an adequate bandage on the hands and feet with a great deal of pressure is important to avoid hemorrhage.

This chapter has covered most of the common cutaneous lesions that will be encountered in an average practice and that lend themselves to surgical excision. Techniques for undertaking this type of therapy have been described and demonstrated.

The limitations of this method are well understood. Certain lesions are not accessible, such as those located near the inner canthus of the eye. Some patients refuse surgery and prefer x-ray or radium therapy. Others, being poor surgical risks or presenting lesions too large for primary closure, are, at times, best treated by irradiation.

It will again be emphasized that in those suited for this type of work that it is relatively simple and most satisfying. The results are immediate and *comparable or better than any other type of therapy.* The unsightly scars and slow healing of electrosurgery are avoided, as are the sequellae such as radiodermatitis that by necessity may follow the most expert radiotherapy.

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4

Indications and Methods of Skin Grafting

Arthur E. Smith M.D. D.D.S. and Marsh Robinson M.D. D.D.S.

This chapter is an introduction to *Skin Homotransplantation*. The methods of homotransplantation of skin will be presented with the indications, contra-indications and the various technical procedures. Grafting means to implant living tissue to form a living union and specifically in this discussion, a portion or all of the skin (and at times attached subcutaneous tissue) inserted into a part of the body in order to supply a covering or remedy a defect. The term *Autoplastic* graft is used and indicates that the tissue transferred or implanted is taken from another part of the same person.

INTRODUCTION

Reverdin was the first to do epidermic grafting in 1869 by placing small bits of epidermis from one area into a granulating surface in the same person to promote healing. This became known as "pinch grafting." His observations received great attention but the unsatisfactory results from scarring and contractions brought this method into disuse. Krause in 1872 reported the successful use of more than 100 grafts by Wolfe's method previously reported of skin-grafting by means of large strips of entire-thickness of the skin denuded of fat. In France Ollier developed a method of dermoepidermic grafting. Later in 1874 in Germany Thiersch developed a similar method to Ollier of skin-grafting with films of epidermis with a portion of the dermis which was shaved off in strips and applied to the surface after shaving down the granulation tissue. This type of graft is frequently referred to now as the Thiersch graft. Foremost among others who have made important advancements in skin grafting are Gillies, Lexer, Davis, Blair, Brown and Padgett.

TYPES OF SKIN GRAFTS

Biologically skin grafts are divided into two main classifications, i.e. autografts and homografts.

An autograft of skin is removed from one location and transferred to a new location on the same person.

A homograft is removed from one individual and transferred to another.

The employment of homografts of skin has been under discussion for years, is unsuccessful and largely abandoned. Considerable research however has been done and is being continued. The consensus of opinion among plastic and maxillofacial surgeons, is that homografts should not be

employed except in giving emergency temporary relief for the severely burned patient. Autografting can be done at a later time.

Autografts are uniformly successful and should be employed whenever possible. In our opinion, rather extensive areas can usually be covered with autografts at one operation. Subsequent grafting can be continued as the patient's condition permits.

Skin grafting occupies an important place in plastic and maxillofacial surgery. It would be indeed a rarity not to need skin grafts at some stage in reconstructing congenital and acquired deformities.

Reconstruction and reparation of deformities also requires a sound knowledge of skin grafting, which is not as simple a procedure as many surgeons suspect. *Successful skin grafting usually results when one is* thoroughly versed in plastic or maxillofacial surgery. This statement applies not only to skin grafting but should be applied to every surgical specialty. There is no "short cut" to the inherent problems of successful skin grafting. A successful result depends upon the following elements:

1. Appraisal of the location and evaluation of the area to be grafted. Preoperative management of the patient and preparation of the recipient area.
2. Judicious selection of the type of graft to employ with the method of application which will accomplish the best functional and cosmetic result.
3. Selection of the donor area must have careful consideration pertaining to skin thickness, color, hirsutism and residual appearance and function.
4. A thorough [illegible] and [illegible]
5. [illegible] burns.

Unless the above basic rules are closely followed, the end result will usually be disappointing.

In general, one can say that the success of the autotransplantation of a portion or a complete skin graft will depend upon the viability of the transplant. This in turn depends upon the ultimate position of the transplant (which must have had a generous blood supply) and the blood supply.

Many new physical and chemical methods are being advocated to effect favorably the balance between the nutritional need of the graft and nutrient supply of the recipient area. They fall mainly into two groups: (1) decreasing the requirements of the edematous graft with the application of cold, and (2) the method to increase the blood supply of the donor area by application of heat. The adaptation of the graft to the recipient area is of fundamental importance and is accomplished by adequate pressure bandaging. A balance by means of pressure must be achieved to prevent a hematoma or serum from collecting beneath the graft and not enough such pressure to decrease the blood supply. The use of chemotherapy has largely eliminated the poor results previously caused by infections. Improved anesthesia, both local and general, and the newer drugs with blood fractions have added to the success of extensive skin grafting.

The functional result of a graft will largely depend upon being adequate for the defect and of such thickness that it will function similar to the lost part with sufficient subcutaneous tissue. Hair, freckles and keloid may be viable and continue in some types of transplanted skin where they are unwanted. The esthetics depend mainly on the color and texture of the graft. The problem of esthetics of the scar at the junction of the graft will depend upon minimizing or concealing this scar with good technical plastic closure. Often in skin grafting the scar-forming ability of the individual becomes of major importance. The so-called *keloid* tendency must be anticipated and recognized. Here the services of a competent radiologist are important to radiate the graft pre-operatively and post-operatively. The judicious use of cortisone is assuming importance.

HISTOLOGICAL STRUCTURE OF THE SKIN

The skin is composed of two principle layers, i.e. the superficial layer called the epidermis and the deep layer, the corium or derma. The two main layers are further divided as follows:

A. Epidermis. Superficial layer (Figs. 16 and 17)
   1. Stratum Corneum. Consists of horny epithelial cells.
      Stratum Lucidum. Composed of scaly cells, closely packed.

Figure 16.—Schematic drawing of skin. Note thickness of graft. Thin split graft is indicated at 1. Intermediate split skin graft is indicated at 2. The small deep split graft is indicated at 3. (Redrawn from Cunningham Anatomy.)

3. Stratum Granulosum. Consists of spindle-shaped cells. The cells are flat and contain eleidin granules.
4. Stratum Germinativum. This layer is composed of perpendicularly packed epithelial cells. These cells are divided into an outer prickle cell layer and a deeper basal cell layer which rests on the surface of the dermis or corium. The outer layers, above indicated in Figure 16 at 1, 2 and 3, are derived continually from this germinating layer 4.

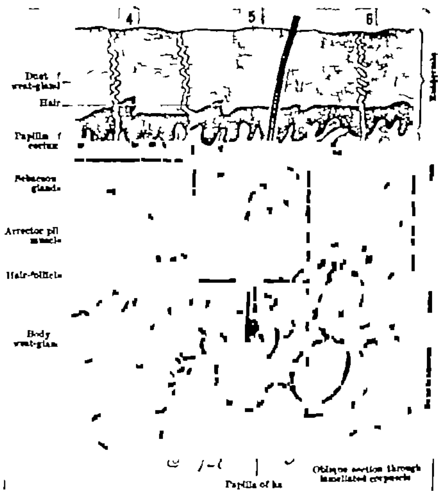


Figure 1[illegible] Schematic drawing of skin [illegible] thickness of graft. Thick split skin graft indicated [illegible] Full thickness [illegible] graft is indicated [illegible] The thickest of [illegible] graft is indicated [illegible] (Redrawn from Cunningham [illegible])

The thickness of the epidermis varies in different parts of the body from 3 mm to [illegible] mm. It is the thinnest on the penis, eyelids and inner surface of the upper arm. It is thickest on the soles of the feet, palms of the hand, and back of the neck.

The stratum Corneum lucidum and granulosum comprise the horny epidermis or superficial skin zone The stratum germinativum or fourth layer is the germinative zone.

B Corium or Derma. True skin (Figs. 10 and 17)

This portion of the skin is divided into two layers

1 The Papillary Layer The outer portion of this layer consists of elevations or folds called papillæ which project outward into the overlying stratum germinativum A capillary plexus, sensory nerves and tactile corpuscles are situated in each papilla.

2 The Recticular Layer The deepest part of the skin is composed of interlacing arrangement of white fibrous and yellow elastic connective tissue blood vessels, lymphatic vessels, smooth muscle fibers, and a plexiform arrangement of nerves The innermost portion projects downward into the adipose tissue

THE THIN SPLIT SKIN GRAFT

The thin split skin graft (Reverdin) contains the first three layers of the epidermis and a portion of the stratum germinativum This graft does not include the entire germinativum layer Average thickness is 0.010 inch (See *1* in Fig 10.)

In 1869 Reverdin removed small split sections of epidermis from the right arm and placed them upon a granulating lesion of the left arm These small grafts united and the result attracted the attention of Ollier (1872) and Thiersch (1874) who are credited with cutting the grafts deeper and larger The original Reverdin thin split graft is of little value in present day skin grafting due to the absence of important skin elements and extreme contraction of the grafted area.

THE INTERMEDIATE SPLIT SKIN GRAFT

The intermediate split skin graft (Ollier 1872 Thiersch 1874) includes the four layers of the epidermis and the ends of the papillæ of the corium Average thickness is 0.015 inch (See 2 in the Fig 10.)

The intermediate split skin graft may be used to cover small areas where contraction and loss of normal skin texture are not important They take very readily even on unclean recipient areas. With present la technique their value and use are limited because now we can cut thick graft with included important germinating elements. Ollier and Thiersch stimulated by the success of Reverdin s thin split graft enlarged the size of the grafts and split them at a deeper level. This improvement wa the stepping stone upon which present day success of split skin grafting is based When this graft i properly cut and applied to an adequately prepared recipient area and followed by proper dressings, a take generally results. The "take will occur on a fresh wound n a granulating urface on an excised scar base on fresh surface of bone and in the mouth if properl immobilized

This type of graft is valuable in lining a prepared pocket utilizing the E ser Inlay t correct contracting tissues in the mouth. It is useful in reating or leepening a buccal sulcus and in covering denuded intra-oral rea When used to correct intra-oral deformities or for lining the orbit

for reception of an artificial eye the graft must be properly immobilized by a special mold or splint However this type of graft is seldom employed on the face or neck due to tissue contraction absence of normal skin resistance and color changes.

Small Deep Skin Grafts.

Small deep skin grafts (Reverdin Staige-Davis) first used by Reverdin and modified by Staige-Davis, are similar in thickness to the Ollier Thiersch graft This graft is slightly thicker than the intermediate split graft (Ollier Thiersch) because more of the papillae of the corium are included Average thickness is 0.020 inch (indicated at *3* Fig 10)



Figure 18 *A* Pre-operative photograph of twenty-three-year-old personnel technician taken November 10 1944 showing papillary pigmented nevus on right cheek and nose *B* Cross specimen of brownish, elevated, rough nevus excised September 2 1946 Compare with *A* *C* The lesion is composed of nevus cells which in the upper corium are typical in appearance being polygonal shape and small oval nuclei. The tumor extends deeper into the tissue however the cells become elongated and the nuclei smaller so that in some places there [illegible] superficial resemblance to non-myelinated nerves The tumor cells are disposed in large masses or small groups and occur from the subpapillary layer of the epidermis down to the subcutaneous fat and muscle but the lesion appears to be fairly [illegible] circumscribed although it is not at all encapsulated. Pigment production varies considerably throughout the tumor although there are a number of nevus giant cells present the tumor does not appear to be malignant in spite of its extensiveness The scarred area shows marked fibrosis and absence of [illegible] cells. There is considerable fibrosis throughout most of the tumor *D* Post-operative photograph shows reconstruction following excision of nevus Compare with *A*

Reverdin's original graft was composed of the epidermis and a thin layer of the dermis Davis improved the graft by including more of the corium and called it the small deep skin graft or pinch graft It is prepared by elevating a small cone of skin with a straight needle held by an artery forceps. The elevated cone of skin is severed at its base with a scalpel The included corium is thickest at its central base and thinnest at its margins. The average diameter of these oval or round grafts is 0 4 cm A narrow rim of skin on the donor area separates the bases of each graft After cutting an adequate number of grafts, the donor area is covered with bismuth tribromothenate gauze strips over which a resilient pressure dressing is applied The small deep grafts are placed in rows, 0 3 to 0.5 cm apart, over the recipient area. The edges of the grafts are flattened then covered with thin fenestrated rubber or plastic material. This is covered with strips of bismuth tribromothenate gauze dry sponges and a resilient rubber sponge under 30 mm of mercury pressure The grafted area is dressed in five days. The area is gently sponged with saline solution and redressed under resilient pressure If granulation tissue is present between the grafts, additional dressings may be indicated every two days Since the advent of methods for cutting large split skin grafts this small deep graft has lost most of its popularity It should never be employed on an exposed area—such as the face The growth of epithelium between the circular grafts produces an uneven spotted and unsightly appearance The cosmetic appearance of the healed donor area is as bad as the grafted area.

THICK SPLIT SKIN GRAFTS

Thick split skin grafts (Blair Brown) include the epidermis and a portion of the corium Average thickness is 0.020 inch (see *4* in Fig 1, also Figs. 18 22)

This thick split skin graft is more efficient and has a wider range of usefulness than any other type of split graft. This wider range of application is because the graft is composed of the entire epidermis and a portion of the corium Its skin elements make possible rapid regeneration of the grafted area with only moderate tissue contraction

Padgett recognized the difficulty of obtaining thick split skin grafts by the free-hand method From 1930 to 1938, he experimented and finally developed the modern dermatome Many modifications of his instrument have been introduced but the basic features remain. In using this appliance the drum is set on a stand and carefully coated with an even layer of rubber cement of good quality The donor area is then thoroughly dried and coated liberally with the same material The cement is now permitted to dry until it is quite tacky In testing for tackiness one should not touch any part of the area to which the drum is applied In general one is inclined to err on the side of not waiting long enough rather than waiting too long Three or four minutes seem most appropriate The leading edge of the drum should be firmly pressed down on the donor area and held in place under some pressure for several seconds. Make certain that the skin is adherent to the drum along the entire edge If the clip which grips the knife blade is kept highly polished the leading edge of

the drum will be reflected in it. It is best to start over again if the skin does not stick to the drum at the leading edge. The graft is cut with a to-and-fro movement of the knife with one hand while the other hand rotates the drum. One should not attempt to apply too much traction on the skin or press the drum too tightly to the skin because this will cause the edge of the knife to cut beyond the sides of the drum. When the end of the drum is reached there is sometimes a tendency to cut too deeply. It is advisable to back the knife off at this point and cut the graft away from the



Figure 19. A, Congenital [illegible] of the forehead of [illegible] old [illegible]. Photograph [illegible] April [illegible]. Multiple excision [illegible] abandoned after three operations. On August 30, 19[illegible] the hemangioma [illegible] excised. The [illegible] [illegible] in thickness. A thick split skin graft [illegible] employed [illegible] did not restore the surface contour [illegible] months later [illegible] full-thickness skin [illegible] beneath the split skin graft [illegible] normal surface contour. B, [illegible] result. Photograph taken in [illegible] completion of surgery. [illegible] normal surface [illegible]. Compare [illegible]

skin with a pair of scissors. In removing the graft from the drum the extreme edge of the tissue should be grasped with a fine hemostat or Allis forceps and pulled away gently at the leading edge. The cement may remain with the drum but frequently adheres to the graft. Because of the cement attached to the graft, there is a marked tendency of the graft to curl which may promote difficulty in manipulation of the graft especially if the graft is thin. At the present time the dermatome appears to be the most popular instrument for removing split-skin grafts of uniform thickness.

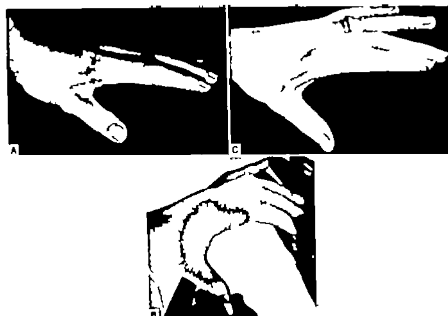


Figure 20 —*A* Photograph present left hand of fift year-old housewif showing keloid scar contracture from p raffin burn on M y 11, 1942. The patient complained of her inability to perform man usual functions. Examination reve led tight, smooth mottled sca over the dorsum of the left thumb including the perionychium. From the base of the thumb thick elevated red keloid scar extended t the second joint of the index finger This scar limited pproximately 8 cm. of thumb extension. *B* Photograph taken t surgery July 2, 1943. (Surgery as delayed to llow for the fullest possible resol tion of the injury) Not graft under normal ski tension Immobilized ith Triple-0 interrupted silk sutures The graft as removed from the right bdominal ll and 0.020 inch in thickness *C* Above photograph shows the plastic surgery result Note normal thumb extension. Compare th A

These graft are then cut in small section or in sheet varying in ze from 4 inches in width l C t S inches in length If a smaller graft of certain shape i needed then the trained plastic or maxillofacial surgeon can rem e it with ease This is accomplished l placing transparent pattern material over and around the area to be grafted The margin of

the area to be grafted are outlined with a dermatographic pencil The pattern material within the marked outline is cut out leaving the shape and size of the area to be covered with skin This fenestrated pattern is placed on the skin over the donor area The rubber cement is carefully painted on the skin through the opening of the pattern Cement is also applied to the dermatome drum The cutting blade is set for the desired

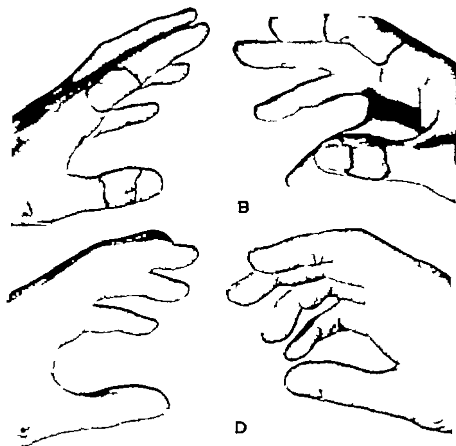


Figure 21 [illegible] and *B* Photographs show the hands of [illegible] fort[illegible] [illegible]-old dentist first [illegible] A [illegible] regarding [illegible] burn [illegible] [illegible] years previously he had exposed his hands t[illegible] -radiation [illegible] taking dental roentgenograms and seven [illegible] previously he noticed skin involvement on the index finger of the right hand (not *B*) At that time he [illegible] given [illegible] therapy [illegible] Examination revealed dense keratotic area on the dorsum of the right thumb over the second phalan[illegible] [illegible] over the terminal joint and involving the person [illegible] [illegible] lesions [illegible] found [illegible] the left index finger [illegible] left thumb and [illegible] finger [illegible] August [illegible] November [illegible] and October [illegible] the [illegible] were excised and replaced [illegible] 0 020 inch thick split [illegible] from the right [illegible] The pathologic report of the removed skin [illegible] roentgen keratosis [illegible] [illegible] squamous [illegible] [illegible] small [illegible] of the skin of the index finger [illegible] Postoperative photograph [illegible] result from 0 020 inch [illegible] graft [illegible] [illegible] Plastic reconstruction is accomplished [illegible] of 0 020 inch [illegible] graft [illegible] compare [illegible] *B* The patient [illegible] still under observation

thickness of the graft. A split skin section of desired thickness and shape is *quickly obtained in accordance to the pattern, leaving a denuded donor* area of the same size This type of graft may be used on any part of the body It is indicated for replacing skin lost from burns (Figs. 20-22) for crushing injuries for denuded areas caused from trauma and for covering an area created from excision of contracting scars and congenital lesions (Figs. 18 and 19) It should not be placed on exposed tendons or over a movable joint. This type of graft will give a better cosmetic result with less contraction than a thinner split graft The surgical result i generally satisfactory but does not equal the result obtained from a good take of

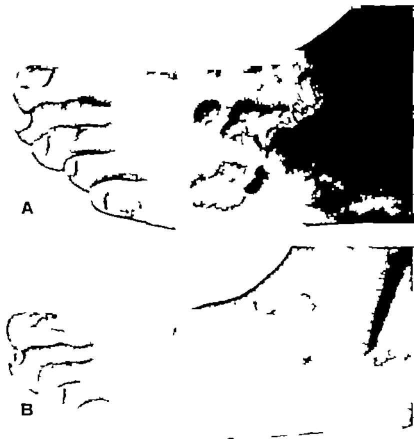


Figure 22 — A Above photograph shows keloid resulting from molten metal spilled in his boot at foundry on the foot of a patient three-year-old Negro laborer Photograph taken on July 6, 1931 four months after the injury Note massive thick keloids. *B* The keloid with some surrounding skin were excised on July 31 1931 The prepared area was grafted with 0.022 inch thick split skin from the abdominal wall Following surgery the patient received three x-ray treatments Photograph shows the post-operative result after one year Compare with *A*

a full-thickness skin graft for function and cosmetic appearance especially on the neck face eyelids, and nose.

The area to be grafted must be properly prepared It must be sterile and dry Accurate placing of the graft with approximation of the skin edges by interrupted Triple-0 silk stitches and with the creating of normal tension on the graft are mandatory

Dressing the Graft —The graft is covered with one thickness of bismuth tribromophenate gauze. This is covered with a number of evenly placed dry gauze plaques and also an adequate amount of fluffed mechanic's waste or a thick section of sponge rubber This dressing is immobilized under 30 mm of mercury pressure by means of adhesive tape or Ace bandage or both

Post-operative Care —The dressing is carefully opened for inspection of the graft on the fourth day providing no necessity arises for earlier examination and redressing The edges of the bismuth tribromophenate strips are carefully elevated for inspection of the graft. If the graft seem in satisfactory condition one should retain the dressings and reapply 30 mm of mercury pressure The second dressing is usually made on the seventh post-operative day at which time everything is removed including the stitches The grafted area is redressed with a number of dry gauze sponges and again covered with mechanic's waste or sponge rubber Pressure is applied as previously done The third dressing is done on the twelfth day The graft is then bandaged without pressure

Plasma which preserves the viability of the graft escapes and fills the spaces between the graft and the host The plasma gradually changes into fibrin and thereby becomes anchored to the host tissue After about twenty four hours delicate vessels grow from the host tissue into the graft After the third day the graft itself takes active part in the regenerative process l marked proliferation of it epithelium Between the fifth and tenth day after the operation depending upon the size and thickness of the graft organic union becomes complete after re-establishment of the interrupted circulation of the graft and the development of a subcutaneous tissue anchoring the graft firmly Besides proliferative changes some degenerative changes such as cell death in the epithelial and endothelial cells and the elastic fibers occur Regeneration takes place later Subsequent changes such as color and contraction may occur Nerves begin to grow into the graft from the surrounding tissue about the third week However innervation may not be complete for several month

THE FULL-THICKNESS SKIN GRAFT (Wolfe-Krause)

The average thickness is 0.0[illegible] inch (see [illegible] in Fig 17) but ranges from 0.020 to 0.070 inches depending upon the location of the donor site and age of the patient The full-thickness graft is the most difficult of all skin grafts to obtain a take but when successful is superior to any type of split skin graft because it possesses all the characteristics of normal skin The changes of this graft in texture color scarring and contraction are much less than those following a split skin graft (Figs 23 [illegible])

The scientifically placed full-thickness graft to correct defects on the forehead [illegible] face (Figs [illegible] and [illegible]) eyelids and nose (Fig [illegible]) usually

produce a good cosmetic appearance Employing full-thickness grafts for reconstruction of the ala, of an eyelid or over a mobile joint requiring freedom of motion becomes important for good function This type of graft likewise should be employed on surfaces subjected to friction and pressure, such as lesions on the palms of the hands and soles of the feet because this type of graft offers greater resistance to the elements and to extreme usage such as weight-bearing and friction (Fig 25)

Technique —The full-thickness graft should be cut exactly to pattern. A graft that is too large will not be completely adaptable to the recipient area and will interfere with healing A graft that is too small and is



Figure 23.—*A* Pre-operative photograph show fifty-year-old housewif on March 12, 1943. Lesion of right heck proved to be lupu vulgaris by biopsy Various methods both local and general failed to eliminate the lesion. *B* Post-operat ve photograph t ken April, 1955, show condition hich t elve years following original graft and nine ears following small graft necessitated by recurrence Examination disclosed the gr ft t be in excellent condition. Compare ith *A*



Figure 24 *A* Pre-operat photograph taken of thirteen- ear-old student on August 26, 1 11 Not the port ine nevus covering the entire right nose extending 4 mm over the midline *B* Post-operat ve photograph taken in 1931 show condition ea ears following excision of the nevus Reconstruction b means of full-thickness skin graf from the medial surface of the right arm. Compare with *A*

sutured to place under too much tension will provoke also an unsatisfactory result. The area of the prepared recipient site can be covered with a translucent pattern material. Using a dermatographic pencil the outline can be drawn on this material and the accurate pattern prepared. It is then placed on the donor area and the correct amount of skin is removed. After the full-thickness skin graft has been excised it is carefully examined and all subcutaneous tissue is removed. The graft is then placed on the recipient site and the margins accurately approximated with interrupted fine silk sutures. Then the donor site must be repaired by either undermining the surrounding skin and suturing or it may be necessary to place a split-skin graft over the area.

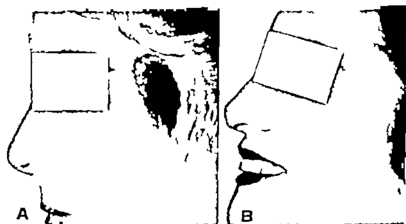


Figure 23.—Pre-operati[illegible] photograph shows [illegible] seven-year-old girl taken June 191[illegible] The pigmented hairy nevu[illegible] dark bro[illegible] in color. On July 24, 1947 the nevus [illegible] excised. A full-thickness skin graft from the left abdominal [illegible] all [illegible] as used t[illegible] reconstruct the area. *B*, Post-operativ[illegible] photograph taken M[illegible]rch, 1955, show[illegible] condition eight y[illegible] ars following surgery. Compare with [illegible]

The ten commandments necessary for success in full-thickness skin grafting are:

1. The [illegible]rea to be grafted must be dry and sterile, whether it be a fresh wound or a granulating surface.

   Thorough surgical preparation of the area t[illegible] be grafted is necessary. For many [illegible]ears we have employed a modified Staige-Davi[illegible] technique with success. Th[illegible] excessive granulation tissue is cauterized with carb[illegible]lic acid after which the granulation[illegible] are reduced or rem[illegible]ed. The area i[illegible] then dressed with bismuth tribromophenate ointment gauze for fort[illegible]-eight hours before operating.

3. Thor[illegible]ugh hemosta[illegible] [illegible] a perfect[illegible] [illegible]ry techni[illegible]u[illegible] [illegible]s mandat[illegible]ry.

4. Careful selection [illegible]f th[illegible] [illegible] [illegible] is essential.

   Th[illegible] graft must be cut [illegible] accurate[illegible]y fr[illegible]m an accurate pattern of the area t[illegible] be graft[illegible]d.

[illegible] Careful [illegible] [illegible]n of the graft from th[illegible] donor [illegible]rea u[illegible]ing small hook[illegible] [illegible] d[illegible]ne t[illegible] a[illegible]oid trauma.

7 Thoroughly remove all fat from the graft because it acts as a barrier through which new and continuous circulation would have to progress in order to reach and nourish the graft.
8. Carefully adjust and approximate the accurately cut graft to the recipient area by means of interrupted accurately placed Triple-0 silk sutures.
9 The graft should be smooth and under normal skin tension.
10 Properly dress the graft utilizing an even pressure equal to 30 mm of mercury



Figure 26.—*A* Pre-operative photograph shows a tattoo on the upper right arm of twenty-one-year-old student. This tattoo had been placed three years previously. On April 2, 1931 the tattoo was excised. A full-thickness skin graft from the left abdominal wall was placed. *B* Post-operative photograph illustrates plastic reconstruction of lateral surface of right arm by means of a full-thickness skin graft. Compare with *A*

Dressing of the full-thickness skin graft is most important for a successful result A uniform 30 mm. of mercury pressure is just as important as the surgery itself No matter how efficient the surgery if the dressing and pressure are faulty the graft will fail to remain viable

The initial dressing consists of placing one thickness of bismuth tribromophenate strips over the operated area covered with several evenly placed gauze sponges. Upon this is added an adequate amount of fluffed mechanic waste or soft rubber sponge The dressing is placed under 30 mm of mercury pressure by means of adhesive tape or an Ace bandage

The dressing is carefully removed on the sixth post-operative day; the graft is examined and the sutures removed. The area is cleansed with saline solution and followed by the application of a mild antiseptic. The dressing should consist of evenly placed dry gauze sponges and mechanic's waste with the same 30 mm. of mercury pressure evenly applied for six more days. The second dressing is retained until the twelfth day. Unexpected complications may require additional care and dressings.

The donor area is closed by removal of necessary fat and undermining the surrounding skin. Deep Double-0 chromic catgut sutures are placed to approximate the subcutaneous tissues. The skin edges are then approximated by a continuous subcuticular No. 32 stainless steel wire. Additional interrupted silk sutures may be employed for better apposition if indicated. The silk stitches are removed from the donor area on the fifth day and the subcuticular wire on the twelfth day. If the donor area is too *large for approximation of the flaps, no fat is removed. The area is covered* with a thick split skin graft and dressing as stated above under "thick split skin grafting."

RHINOPHYMA

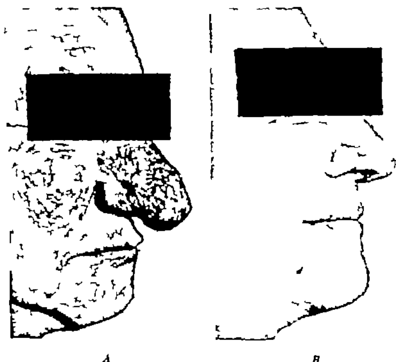
A thorough study of domestic and foreign literature discloses many medical and surgical methods of reconstruction of rhinophyma ranging from superstitious rituals to partial excision of the nose (Fig. 77). For many years, we operated patients with a rhinophymatous deformity by employing two surgical methods described in the literature but without acceptable functional or cosmetic results. Some authors advocate the excision of the rhinophymatous tissue leaving the area denuded, expecting the denuded surface to epithelize to produce a satisfactory skin covering. In our opinion, based on experience, this conception of skin regeneration is a fallacy. Other authors advocate grafting by split skin but in our opinion the end result is nearly as bad as leaving a denuded area for expectant skin regeneration. These methods will not produce a physiologic result. The literature reveals only a few authors who advocate the use of a full-thickness skin graft and others declare that a full-thickness skin graft should not be attempted because the graft will not "take."

The nose should possess a normal skin covering. The nose occupies the most prominent location on the face and is subjected to trauma, cold weather and the burning sun. Correction by means of epithelization and fibrous tissue or by a split skin graft will produce a nose abnormal in color composed of dense nonresilient tissue which will not resist heat, sunshine or cold weather. Cyanosis, telangiectasis and peeling of the skin are common complaints of such treated patients. Normally the bony and cartilaginous framework of the nose is covered with skin, subcutaneous tissue and a small amount of muscle tissue. In operating a rhinophymatous nose all pathologic tissue should be excised leaving the bony and cartilaginous framework. A good result cannot be obtained unless the lost full-thickness skin is restored. We are of the opinion that loss of full thickness skin graft as reported by several surgeons was due to faulty surgical technique or failure in the application and maintenance of an even 30 mm. of mercury pressure dressing.

A full-thickness skin graft placed on the nose should "take" if the basic surgical principles are combined with applied mechanics. In 1942 we placed this idea into actual practice and the surgical results have proved to be highly satisfactory with 10 patients and without the loss of a single full-thickness graft.

Technique

1. From an accurate face mask, an artificial stone model is cast.
2. The rhinophymatous nose is sculptured on the model to normal size.
3. To the sculptured nose a sheet of wax $\frac{1}{8}$ inch in thickness, is adapted over the nose. This is wax model number one.
4. Wax model number two is made from a sheet of wax, $\frac{1}{16}$ inch in thickness. This is molded over wax pattern number one. Wax pattern number two is invested and cast in silver which is $\frac{1}{8}$ inch



A B

Figure 2[illegible].—Pre-operative photograph showing fifty-three-year-old retired farmer. Note pronounced rhinophyma which began at the age of forty-one. He stated that he [was] operated six years ago but the surgical result was disappointing. Four years ago another doctor treated his nose with "salve" and sulfa drugs internally. Two years ago another doctor treated his nose with x-ray and hot packs. All treatments proved worthless. Our examination revealed a nose double normal size. The skin was very nodular, rough, full of deep pits, crevices, and grooves. Copious foul-smelling infected material exuded upon moderate pressure. The patient was mentally depressed because of his appearance and from derogatory remarks. *B* Post-operative photograph showing reconstructed nose by means of a full thickness skin graft from the lower right neck employing plastic and mechanical principles. Compare with *A*

larger than the sculptured nose The plastic material compensates for the size of nose being operated

At surgery the rhinophymatous tissue is completely excised An accurate transparent pattern is made of the denuded area A full-thickness skin graft is removed from the supraclavicular area in accordance with the pattern.

6 The accurately cut graft is placed over the recipient area and it edges approximated to the surrounding skin edge by means of interrupted Triple-0 silk sutures.

The silver mold is lined with $\frac{1}{16}$ inch sterile soft modeling compound The plastic modeling compound lining the silver mold compensates for variation in nasal dimensions.

8 Counter pressure is accomplished by firmly packing the nares with medicated gauze The prepared mold is pressed down on the graft. *This produces an accurate form-fitting model.*

9 The graft is covered with one thickness of bismuth tribromophenate gauze This form-fitting mold is immobilized with adhesive tape under 30 mm of mercury pressure

10 The mold is removed in four days for inspection of the graft and sponging with saline cotton sponges. The mold is reapplied under similar pressure The second dressing is on the seventh day at which time the stitches are removed The mold is reapplied and remains until the twelfth post-operative day This molded plastic material held by a form-fitting silver mold creates uniform pressure over the bony and soft tissue foundation One of our patients operated by this technique is shown in Figure 27

Tubed Graft —The tubed graft is prepared by first selecting the donor site and then by determining the amount of tissue required to cover the recipient area which will govern the length and width of the graft No definite rule can be given as to the length and width of the flap to be raised and tubed This must depend upon it location and blood supply The average ratio is two and one-half in length to one of width. Two parallel equal length incisions are made through the skin including some of the underlying fat The ends of this skin parallelogram are left attached The tissue between the parallel incisions is elevated and the skin edges are approximated without tension with subcuticular fine stainless steel wire and if needed interrupted silk sutures. The donor area from which the bipedicled flap was raised is closed with subcuticular No. 30 stainless steel wire and interrupted silk sutures. The preparation of this type of graft in most instances is on the lower neck (Fig 28) upper chest abdominal wall (Fig 30) and inguinal region

Less frequent donor areas are

1 Back
2 Occipital region
3. Temporal forehead
4 Diagonal cervical
5 Transverse cervical
6 Medial aspect upper arm over scapula and posterior to ear

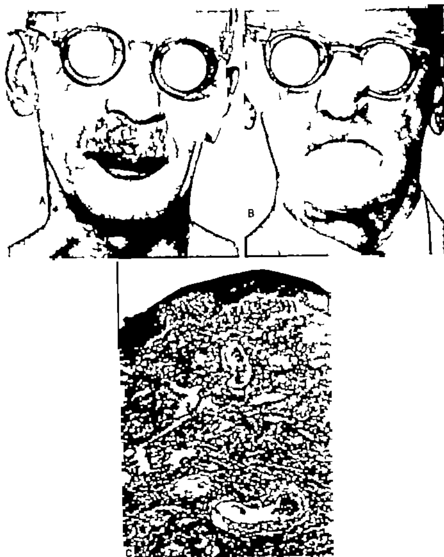


Figure 28.—*A* Pre-operative photograph show forty-nine-year-old engineer ho as referred May 31 1945, for treatment of large tumor of the upper lip. N treatment had been ttempted until he forty-five years of age At that time the arteries on both sides of the lip ere ligated and -radiation therapy as given. There no pparent change in the size of the tumor The following year treatment th radium affected slight hrinkage of the lesion. The patient complained of ppearance of the lesion, interference ith speech, and fear of malignancy as the tumor as enlarging The hemangioma (proven by biopsy June 1 1945) involved the entire upper lip from the angles of the mouth t the floor of the nose Not tubed graft prepared Jul 23, 1943, on the right upper chest. *B* Photograph show postoperative result The cavernous hemangioma, shown in *A* excised and the lip reconstructed by the tubed graft. Not balanced lip of normal thickness and normal lip line *C* Photomicrograph of cavernous hemangioma excised August 14 1946

There are four methods of utilizing a tubed graft

1 If the area to be grafted is near the prepared tubed graft ne end is severed and then opened and rotated over the recipient area The skin edges are sutured to the skin edges of the recipient area

2 Migration by the waltzing method is employed at times. If the area to be grafted is at a distant point one end of the tube is detached

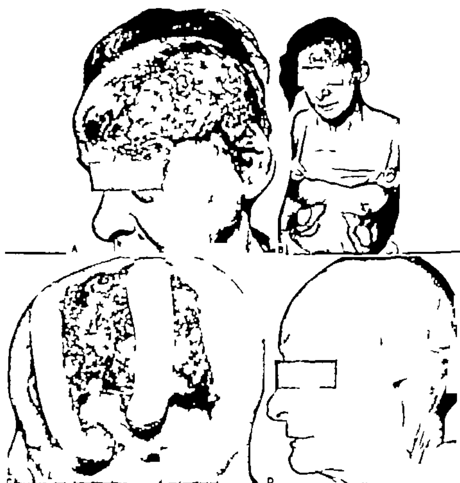


Figure 2 Pre-operativ photograph show sevent ea-old patient ho first seen July 2 1 18 bec use of an terns lesion of the left scalp The patient had history of progress l expand ng lesion of the sc lp for period of t enty ears Biopsy revealed he lesion t be ba l 0 rcinoma B Photograph how large tubed graft prep red December 20 1 18 l each operations the tubes re t rned over and over un il on November 6 1 50 recon truct on of the scalp at lizing these tubed graft possible C Photograph illustrates t bed graft por tion Not the left ear h been removed C resulting neatresting on removed bone over left erebral hemisphere D Pho ograph ll trates graft coveri g left cerebral hem phere Com pare ith A The patient made uneventful recovery from these surgeries but sub sequently died of the disease Mar h 1954

and then turned over and attached at a new site. This procedure is repeated until the tube has reached the recipient area

3 Migration by caterpillaring may be used This method i utilized when the tube cannot be rotated without creating tension on the attached pedicle This is accomplished by moving the detached end forward and parallel to the tube and reattaching This process can be repeated if necessary

4 Migration of the tubed graft may be transferred by means of an intermediary agent such as the forearm hand or leg

Testing Tube Blood Supply before Migration —Adequate blood supply in the graft must be determined for its survival before one end is severed and reattached to its new location This is determined by placing a ½ inch in width rubber band near the pedicle to be severed producing constriction. If the tube remains pink, after applying constriction for fi e minutes, the end can be detached rotated and reattached by the trap-door technique. In our experience three weeks is the average time for an adequate blood supply to be re-established When the tube is detached turned over and reattached before the blood supply is adequate the turned or severed end will be lost from necrosis.

PARTIALLY DE EPITHELIZED FULL-THICKNESS SKIN-ADIPOSE SUBDERMAL TRANSPLANTS.

Cutis or dermal transplants have been used since Otto Loewe s work in 1913. Most efforts in the past have been directed towards correction of surface contour defects with fat bone or cartilage grafts. Fat has universally been disappointing due to its absorption. Cartilage and bone transplants, because of their rigidity are disappointing in areas of motion and flexibility The correction of post traumatic depressions of the face the twisted depressed nose and ala associated with cleft lip and palate the atrophied female breast and loss of subcutaneous tissue over the tibia have been problems to restore permanent good cosmetic surface contour

Technique —The depression is outlined and a transparent pattern made An incision is made through the skin sufficient to admit the graft. This incision is made from 1 to cm from the edge of the concavity in an area of good blood supply and located if possibl to hide the scar The skin is elevated over the surface defect. The donor area, usually the abdominal wall, is outlined according to the pattern With a sharp knife a thin layer of epithelium (approximately 0.003 to 0.005 inch) is removed from the surface to effect capillary bleeding in all areas of the graft The outline incision for the graft i then carried through the skin and fat The graft is elevated and excised leaving ufficient adipose tissue to overcorrect the conca ity abo t 10 per cent Extreme care is used to avoid trauma to the adipose tissue H ok are used t handl the graft Equidi tant retention button area are marked on the skin bey nd the urface of the outline of the concavit The rubber retention buttons are spaced 1.5 cm. apart around th outline of th concaved surface Using two straight needles threaded at each end of Ize 0 silk, sutures are pla ed on equidistant marks 1.5 cm apart t the edge of the graft corresponding to the mark on the skin around the area to recei e the graft Thus the threaded needle at the first end of

After placing an adequate number of U type stitches the graft is pulled through the incision underneath the flap with equal tension applied on all stitches until the graft occupies the concavity making sure that the stitches *are not twisted and that the graft is smooth. Care must be used not to* cross these sutures. After all sutures are in place the graft is drawn into position with the partially de-epithelized surface upward Each pair of stitches are tied over a 0.5 cm in diameter rubber retention button the graft should be under normal skin tension when all sutures are tied A [illegible] cm small Penrose drain may be employed for twenty-four hours. A dressing is applied with approximately 30 mm of mercury pressure

Statements have been made in the past that the cutis or dermal transplants with attached fat undergo such extensive atrophy that cartilage or bone should be used wherever possible The long term follow-up in our series of cases shows that this has not been the result. Where soft tissue has been lost and in areas where mobility is required this technique of soft tissue transplants has given excellent results and in our opinion is the one of choice This surgical technique produces (1) normal surface contour ( ) the grafted area i soft and pliable (which cannot be produced from cartilage or bone implants) (3) muscle and motor nerve function are normal (4) normal appearance is established and the emotional status is improved.

Why do these grafts survive? It is our opinion based on clinical observation that pure fat grafts atrophy from lack of nutrition. The partially de-epithelized skin with attached fat survive due to the nutrient plasma received through the two contacting raw surfaces of skin This is sufficient until a new blood supply is established

The Delayed Flap —This method of the delayed flap was described by Treves and used by Thiersch in 1870 It use was popularized by Blair The delayed flap is important in plastic reconstruction because this procedure will increase the blood supply through the pedicle before moving the flap There are two methods of accomplishing this result Two parallel incision of the desired length and width are made The skin and sub*cutaneous tissues are elevated leaving the proximal end attached* but severing the distal end The distal detached flap is replaced and the skin edges are approximated with interrupted silk sutures. This method requires three weeks for healing before flap transference Another method is to have two sources of blood supply of which one is through a full-width proximal pedicle and the other is through a one-half width distal pedicle In ten days the small skin attachment at the distal end is severed The blood supply of the flap tissues should be adequate for flap migration after three weeks

The Sliding Flap The sliding flap is prepared near the lesion to be repaired In some instances this method is valuable for filling defects. The flap consists of skin and subcutaneous tissues. The flap is extensively undermined then tested by rotating to determine if adequate relaxation has been secured for the graft to cover the defect The unipedicled flap is

elevated and immediately rotated over and attached over the area to be grafted. This procedure is inferior to the delayed flap technique as described above. If the blood supply is not adequate for tissue viability, the distal portion of the flap will necrose.

The Jump Flap.—The jump flap is migrated to a distant point by means of an intermediary agent. The flap to be attached is really a prepared "tubed graft." The lower end of the "tubed graft" (usually prepared on the abdominal wall) is attached to the forearm, wrist, or hand. When healing is complete, the upper end of the tubed graft is severed. The arm with attached graft is brought upward for attachment of the graft to the defect on face, nose, neck, etc. The intermediary agent saves considerable time in comparison with the necessary "turn-over" multiple waltzing operations. Most patients object to the rigid immobilization of the arm and forearm during the period while the tubed graft is becoming attached. However, most patients will co-operate when the saving of time and a lessened number of operations are explained to them.

Full-thickness Skin Graft Including Subcutaneous and Adipose Tissue.—This graft differs from the full-thickness skin graft in two ways: first, it is composed of full-thickness skin, subcutaneous tissue, and fat—also varying in thickness from $\frac{1}{16}$ to $\frac{1}{2}$ inch; second, during preparation of the graft, it is attached with pedicles at both ends.

This full-thickness skin graft including subcutaneous and adipose tissue, being composed of all these tissues, should not be attempted as a free graft. The viability of this rotating graft is retained by a two-step delayed flap procedure.

The first operation consists of making two parallel incisions of sufficient length and depth and including sufficient tissues between the incisions to cover adequately the defect. The pedicles at each end are not severed. Sutures are placed and the graft covered by a pressure dressing. Three weeks later incisions are made in the same locations as previously. The distal pedicle is severed and the graft, consisting of desired thickness of fat, is elevated, rotated over and sutured to the prepared recipient area. Usually the donor area, created by elevating and rotating the flap, is closed by approximating the side flaps with chromic gut and subcuticular No. 3? stainless steel wire. If the area cannot be closed by approximation, a thick split skin graft is employed. The viability of the graft is enhanced by the delayed procedure and is maintained by the pedicle. The graft must be prepared so when it is rotated it will cover the prepared recipient area. Interrupted sutures are placed and a 30 mm. of mercury pressure dry dressing is applied without interfering with blood supply at the pedicle. In twelve days the pedicle is severed and its base is returned to the donor area. The greatest value of this type of graft is its thickness which makes possible the reconstruction of a deep wound, especially over a joint, denuded bone, or an area requiring thickness and resilience of the healed tissues. If a full-thickness skin or split graft is employed to cover a deep lesion, the healed area remains concave without normal surface contour, resulting in restricted freedom of motion, impaired resilience, and thus presenting an undesirable cosmetic appearance.

Free Composite Graft.—This free composite type of graft from the ear to nose was suggested by Barrett Brown and has proven successful in our hands. This composite graft is used for reconstruction of an ala. The donor area is the helix of the ear. Careful measurements are made of the alar defect which receives the graft.

We take an impression and cast a model of the nose. The alar defect is restored on the model in plastic material thus creating normal surface dimensions and contour. This model is the size and shape of the graft needed for reconstruction. During the operation the model is placed over the helix donor area and its margins are indicated on the skin by a dermatographic pencil. The graft is removed by a sharp through-and-through incision in accordance with the model. Following the removal of the graft a V-shaped section is removed from the antihelix to facilitate approximation of the donor area. The excised composite graft is fitted to the prepared edges of the ala. Accurate approximation of the skin edges by Four-0 interrupted silk sutures is mandatory. Both nostrils are tightly packed with bismuth tribromophenate gauze which preserves normal anatomical form of the adjacent tissues. The grafted area is dressed with one thickness of bismuth tribromophenate gauze over which is placed several thicknesses of dry gauze sponge cut to proper size. The operated area is immobilized by a form-fitting metal nasal splint. The lower part of the splint is squeezed to create moderate pressure on the graft. The lower border of the graft is left exposed for inspection. The area is dressed on the fifth post-operative day. The intranasal packings are removed and the graft is sponged with saline solution and redressed with nasal packings and surface dressing. The second dressing is done on the twelfth day. Nasal splint and intranasal packings are removed on the eighteenth post operative day.

Unpedicled Composite Graft (Abbe).—This unpedicled composite type of graft is valuable for correcting a short and scarred upper lip. Usually this deformity results from the excision of too much tissue for cleft lip closure by an operator not trained in cleft lip surgery. Modern cleft lip surgery does not create a scarred distorted and contracted lip. Accompanying this upper lip deformity is a long and protruding lower lip. The unpedicled composite graft corrects both upper and lower lip deformities. Surgical correction is done in two stages. The amount of tissue needed to widen the upper lip and the amount necessary to reduce the lower lip to normalcy must be determined by measurements. Intermaxillary wires are placed to immobilize the jaws. The upper lip is divided most often in the midline which automatically creates a V-shaped split opening. The apex of the V extends sufficiently upward to create adequate relaxation of the tissues below the base of the columella. The depth of the V in the upper lip indicates the length of the graft to be transferred from the lower lip. The V-shaped pattern of proper width and length is placed over the midline of the lower lip and its margins are indicated on the skin by means of a dermatographic pencil. A through-and-through incision is made through the lower lip on one side extending from the vermilion surface to the apex of the V. The opposite incision extends upward from the apex of the V to a point 4 mm below the muco-skin junction. This composite graft is

lifted rotated upward on its unilateral pedicle and fitted into the V-shaped space of the upper lip The lower lip is closed in the usual manner The mucous membrane and skin flaps of the graft are carefully approximated to the edges of the lip. The patient receives nourishment via nasal or mouth tube The pedicle is divided in eighteen days and the intermaxillary wires are removed

The Delayed and Lined Flap —This type known as the delayed and lined flap with its many modifications, may be employed for restoring a partial or total loss of an upper or lower lip, for reconstructing a full-thickness cheek or partial or complete lower half of the nose. Extensive loss of tissue involving the cheeks, lips, and nose require careful evaluation and study in deciding the best surgical procedure to obtain the best functional and cosmetic result. Only the trained and experienced plastic or maxillofacial surgeon should attempt this type of reconstruction and reparation

If tissue loss is too extensive to employ hinged or rotating flaps prepared near the defect, as advocated by Ferris Smith then restoration by a delayed and lined flap is indicated On some patients the graft may be prepared on the neck however its preparation at a distant point is generally preferable thereby eliminating scars on the neck. If the tubed lined graft is prepared on the arm or upper chest, it is advanced by caterpillaring it to the face If the graft is prepared on the abdomen it may be advanced by the "jump" method *i.e.* by attaching the proximal end of the tube to the lower forearm or hand When a full-thickness lip or cheek is to be reconstructed then a compound tubed graft is prepared. The distal end of the tubed graft must be flat and must be covered on both sides with epithelial tissue, one side for lining the cheek and the other side for surface skin covering

The composite tubed graft is prepared by making two parallel incisions of a predetermined location length and distance apart. The flap between the pedicles is elevated including a thin layer of fat. A full-thickness section of skin of adequate size (which is to be the cheek lining) is removed with a thin layer of attached fat from a non-hairy area on the inner surface of the thigh or arm This graft is inverted and placed beneath the upper end of the bipedicled skin flap and then sutured with Five-0 plain catgut under normal skin tension. The edges of the remaining skin flap are approximated with Three-0 interrupted silk and a 30 mm of mercury pressure dressing is applied The area is dressed on the seventh day and again on the twelfth day On the twenty-first day the flap is raised and is tubed not including the buried graft region. The donor area is closed by approximation or by a split skin graft The area is dressed in the usual manner In three weeks the graft is tested for adequate blood supply and if the tube remains pink it is ready for advancing by caterpillaring or by the "jump" method If the graft is prepared on the arm or upper chest the caterpillaring method is used The lower pedicle is severed moved upward as far as possible and reattached by the trap-door method If the compound tubed graft is on the abdominal wall advancement by the "jump" method is indicated The lower end pedicle is severed and attached to the wrist or hand Immobilization is accomplished by means of a thin well-padded plaster cast In three weeks the graft is tested for blood supply and if it

is found to be satisfactory the upper end of the tubed graft containing the inverted skin graft is severed Then the arm is brought upward and is immobilized in a comfortable position by a thin well-padded plaster cast The edges of the cheek defect are prepared The edges of the inverted skin graft are approximated to the edges of the mucous membrane of the cheek. The skin edges of the graft are approximated to the surface skin edges. In three weeks if healing is adequate the tubed graft is severed and final tissue adjustment is done

Reconstruction of extensive loss of the upper or lower lip may be accomplished by advancing a delayed and lined graft by the jump method. The technique is similar to reconstruction of full-thickness loss of the cheek, as described above with some exceptions. Two parallel incisions of predetermined length and distance apart are made on the abdominal wall The skin with 5 mm. attached fat is elevated between the pedicles. Measurements are made of the area to be reconstructed Two grafts are employed one being mucous membrane and the other skin Patterns are made from plastic material which determine the size of the grafts. The first or mucous membrane graft is removed from the cheek just below the opening of the parotid duct. The second graft consisting of full-thickness skin including mm of fat is removed from a non-hairy area on the inner surface of the thigh or arm The edges of these two grafts are attached by Five-0 plain catgut The combined muco-skin grafts are placed in an inverted position under the upper portion of the skin flap The position of the mucous membrane graft depends upon whether the upper or lower lip is being reconstructed Sutures are placed creating normal skin and mucous membrane tension A pressure dressing is applied The area is examined and is dressed in seven days and again in fourteen days. On the twenty first day the flap adjacent to the lower pedicle is elevated and tubed The tubing does not include the upper pedicle which contains the combined muco-skin inverted grafts. A pressure dressing is employed The floor area above the lower pedicle is closed by approximation or by split skin The area is examined and redressed in seven days under moderate pressure This is repeated on the fourteenth day In twenty-one days, if test reveal adequate blood suppl the lower end pedicle is severed and attached to the wrist by the trap-door method In three weeks the upper pedicle is divided above the implanted grafts. *The arm is brought up and immobilized* so the graft will reach the recipient area without tension. The distal end of the graft containing the muco-skin implants is sutured to one side and to the base of the lip defect The mucous membrane graft covers the lip line and restores the muco-skin junction. The skin graft insert covers the lower inside portion of the lip The pedicle remains attached for three or four week and then is excised and attached to the opposite side of the lip defect and sutured

The delayed lined tubed graft method may be used to restore the lower half of the nose including the columella and alae If the graft is prepared on the upper chest or arm as advocated by Ferris Smith it may require caterpillaring Whatever method is employed the graft should be in proper position and should possess adequate relaxation for adjustment and attachment of the prepared end containing the inverted skin graft to construct the ala columella and nasal tip over silver model

The preparation and migration of a tubed graft from the abdominal wall requires several operations and is time consuming It should be used only to restore massive loss of tissues. If this cannot be done without creating excessive scarring and distortion, then the tubed graft, migrated by "waltzing or caterpillaring must be employed to produce a satisfactory functional result and a good cosmetic appearance We are sure this is the desired aim of every plastic and maxillofacial surgeon

Delayed Composite Flap —The operative procedure for preparing and placing a composite delayed flap is herein explained for correction of deformities involving the helix and antihelix of the ears.

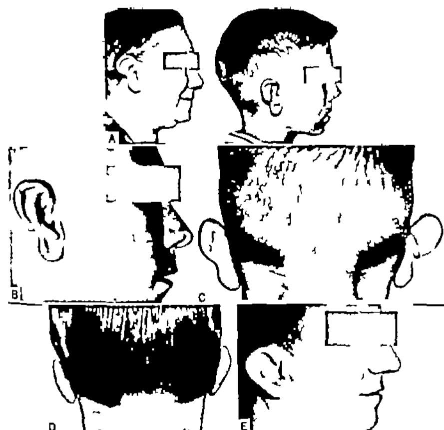


Figure 30.—*A* Pre-operativ photograph show fourteen- ea -old schoolboy th congenital deformity of the ears Not mother ith small deformity of underdevelopment of middle third of ear *B* Close-up photograph of deformed right ear *C* Pre-operative photograph show that both ears had similar deformities However mother possessed only right ear deformit See *A* *D* Post-operat ve photograph show plastic reconstruction completed Final procedure as the placement of ears in normal anatomic position. Not balanced ear Compare ith *C* *E* Post-operat ve photograph show reconstructed right ea This photograph as taken seventeen ears following plastic surgery Compare th *A* *B* nd *C*

1 A face mask and a cast model are made

2 The depressed and underdeveloped helix and antihelix are corrected on the model to produce a normal anatomical appearance of the ears. This is done to determine the exact length width and shape of the composite graft to be inserted A through-and-through incision of sufficient length is made on the model to divide the helix and antihelix The incision usually extends from the lower portion of the scaphoid fossa to the center of the lobule. The bipedicled helix is pushed posteriorly until a normal contour is established An elliptical space between the helix and antihelix is created A wax impression is taken of the space which is inverted and cast in metal This accurately made model represents the exact size and shape of the composite tissue inlay for correction of the deformity The correction is divided into three operations.

Operation one consists of making two parallel incisions posterior to the ear usually 1 5 cm apart and 3.5 cm in length *The skin between the* incisions is elevated between the pedicles. A full-thickness section of skin with 3 mm of fat which is 3.5 cm in length and 1 cm in width is removed from the abdominal wall inverted and then inserted below the distal portion of the flap. The inverted skin graft is sutured under normal skin tension with Five-0 plain catgut The surface skin edges of the elevated bipedicled flap are approximated to the adjacent skin edges with Triple-0 silk. Pressure dressing is applied for seven days. On the seventh day the surface stitches are removed and the area redressed under pressure The second dressing is done in two weeks. The uniting of the surface skin-fat with the inverted skin graft produces a composite graft

Operation two is done three weeks post-operatively The distal end of the composite graft pedicle is severed The flap is elevated downward to the proximal pedicle The distal portion of the flap is covered with epithelial tissue on both sides An incision of sufficient length is made to separate the helix and antihelix The incision which must be the same length as the metal model usually extends from the scaphoid fossa to the lobule The model is placed on the distal end of the composite graft directly over the skin implant The size of the composite tissue inlay is determined by cutting through the graft at the margins of the model The lower third of the inlay is not severed but is retained for blood supply of the graft The prepared flap is rotated over the elliptical space between the helix and antihelix The upper two-thirds of the composite graft is fitted into the elliptical cavity and sutured in place

The donor area is closed by approximation

Operation three is usually done two weeks following the insertion of the composite-inlay graft The lower third of the elliptical tissue inlay (which is retained for blood supply) is severed at the metal model outline fitted into position and sutured The proximal portion of the flap is returned to the donor area and sutured

The authors wish to acknowledge the valuable assistance with the manuscript and for other helpful suggestions received from [illegible] Lee Larson M.D. of Los Angeles, California

Appreciation is expressed to Mrs Dorothy [illegible] Field our secretary for her efficient stenographic work and diligent co-operation in the production of this chapter

5

Oral Plastic Surgery

Bernard G. Sarnat, M.D.

INTRODUCTION

Any text on surgical dermatology would be incomplete without consideration of the problems encountered in the oral cavity and related structures. Surgery of the skin deals primarily with soft tissues, that is, the skin and subcutaneous tissues. Surgery of the oral cavity deals not only with the mucous membrane and underlying soft tissue but also with muscle and bone. The surgical lesions common to the skin are frequently found in the oral mucosa. In addition, special local lesions related to the dorsum of the tongue, the tooth and its supporting structures, as well as local manifestation of systemic lesions of the soft tissue and bone must always be considered.

The material which follows in this Chapter will in no way attempt to be a detailed description of the diagnosis and treatment of surgical condition of the mouth. Rather it will deal with the general problem of diagnosis of surgical conditions, the surgical principles involved, with mention of possible procedures, and several examples illustrating different surgical problems encountered as well as methods of treatment. The purpose is to bring out the minor variations of the general surgical theme. Surgery of the oral cavity and related structures is essentially no different from surgery elsewhere in the body. The same principles of general surgery must be followed and not violated. Frequently the principles of plastic surgery must be employed in the treatment of oral surgical problems. Plastic surgery, whether in the mouth or elsewhere, requires accurate planning, precision and meticulous attention to detail.

Surgery in the mouth is complicated by the relatively small size of the field, difficulty in approach and exposure and the need for suction of saliva and blood to maintain both visibility and an open airway. When general anesthesia is necessary, oral or nasal endotracheal intubation is used in order to remove the anesthetist as well as his apparatus from the field. One must remember that surgical judgment, which can be developed only by experience, is important to determine whether the problem is a surgical one or not. When surgical intervention is indicated the patient must be carefully evaluated in terms of anesthetic and surgical risk for the procedure to be undertaken. Proper pre-operative and post-operative care are neither to be neglected nor forgotten. And lastly will this surgical procedure be of benefit to the patient in terms of his future life? What con-

plications are to be anticipated including disabilities of function and appearance of the region? Can they be corrected or improved at the time of initial surgery or will subsequent plastic surgical corrective procedures be necessary?

ORAL LESIONS

General Principles of Treatment

Pre-operative Care.

The same general principles of pre-operative care pertain to surgery of the oral cavity as to surgery elsewhere in the body. These aspects will not be discussed. A few comments, however, are in order. Acne or other infections of the face or mouth or an upper respiratory infection may be pre-operative contraindications. The beard should be closely shaved just prior to the surgical procedure and all cosmetics and non-fixed dental appliances should be removed. Occasionally for certain operations it is necessary to insert the dental prosthesis if it influences the contour of the mouth, lip or cheek. Oral hygiene should be adequate.

Anesthesia

Many oral surgical procedures can be carried out best by means of local anesthesia. A 1 per cent solution of procaine hydrochloride with the addition of 1:50,000 or 1:100,000 epinephrine is a satisfactory anesthetic agent. The reader is referred to other sources for the techniques and sites of administration of local anesthetic agents. An awake and co-operative patient can frequently facilitate the performance of the surgical procedure. General anesthesia is necessary for certain operations and in unco-operative patients, particularly infants and children. In these instances endotracheal anesthesia is most satisfactory because it permits the anesthesiologist and his apparatus to be away from the surgical field. In addition the hypopharyngeal region can be packed with gauze to intercept blood or other foreign material from entering the trachea. Cautery or surgical diathermy can not be used with most general anesthetic agents because of the associated explosion hazard.

Operative Care

The same general principles of operative care apply to surgery of the oral cavity as elsewhere in the body. In addition the principles of plastic surgery must be adhered to in the use of intraoral plastic procedures. Based upon the correct diagnosis, location and extent of the lesion the appropriate surgical procedure is planned. This plan may be modified as unforeseen problems arise. The ultimate goal should be to obtain as near normal function and appearance as possible.

Intraoral surgical procedures are facilitated by the use of suction to aid vision and keep the area clear. In addition the use of a unilateral mouth prop to keep the jaws apart and a tongue tied to direct the relaxed tongue are of considerable help in the patient who is given a general anesthetic agent. Tissues should be handled gently but skillfully. Sharp knives are important for regular incisions at right angles to the surface. Fine skin hooks and traction sutures are less traumatic than tissue forceps. The

undermining of tissue should be precise and adequate. Preservation of the blood supply and hemostasis are important.

The final step in a surgical procedure is the closure of the wound. If there has been no loss of tissue, closure offers no problem. Fine but suitable suture material and needles should be used. Careful approximation of tissues in layers without tension is essential. When the tissues do not permit direct closure without tension, approximation may still be attained by *undermining the wound margins or by making one or more incisions* lateral and parallel to the wound (relaxing incisions). If the loss has been extensive, however, closure can be effected only by the use of a skin graft or flap. Draining areas should be kept partially open to permit escape of the contents. Adequate pressure dressings where possible facilitate healing of the wound.

POST-OPERATIVE CARE.

Surgery about the mouth may be complicated post-operatively by continued hemorrhage or a blocked airway. The patient should be turned on his chest or abdomen so the fluids can run out. In addition, the foot of the bed may be elevated. A mouth prop, air way, towel clip or tongue forceps and suction machine should be conveniently placed in the event that they are needed. The previously placed tongue stitch may be removed after the patient has recovered adequately from the general anesthetic.

Generally, wounds of the oral cavity heal well. The fact that it is a warm, dark, moist cavity which houses a varied bacterial flora and which is subject to the trauma and motion of mastication does not usually interfere with healing. The routine use of chemotherapeutic or antibiotic agents is neither recommended nor necessary. The diet, depending upon the particular surgical procedure, may vary from a clear liquid to a soft non-chewy consistency. It is important that it be made as appetizing as possible and include an adequate number of calories and essential foodstuffs. The use of an asepto syringe with attached rubber tubing (approximately 6 inches in length) inserted in the oral pharynx may facilitate the dietary intake. Oral hygiene is essential. Hot normal saline (500 cc.) used as an irrigation or mouth wash will mechanically cleanse the mouth and reduce the inflammation and pain. This can be done several times a day, beginning about twenty-four hours post-operatively. The addition of 50 to 100 cc. of 3 per cent hydrogen peroxide to the solution or on cotton applicators will facilitate the cleansing action. A soft small tooth brush and dentifrice should be used when possible. This can be followed with a flavored mouth wash. The vermillion border of the lips can be anointed with mineral oil or cold cream in order to keep them soft and free from drying, crusting and cracking.

PLASTIC SURGERY

The general principles of plastic surgery are essentially those of:

1. Correction of deficiencies by transferring new tissue obtained either from the immediate surrounding area (direct flaps) or from some more distant part of the body (indirect flaps, free grafts).

2 Removal of excess tissue
3 Repositioning of tissue which may be adequate in amount but not in position.

These three groups include practically all procedures in plastic surgery. They are concerned essentially with the shifting of tissues either local or distant. Because of these procedures plastic and reconstructive surgery has been described to the layman as a procedure of "robbing Peter to pay Paul."

FREE TRANSPLANTS

AUTOGENOUS GRAFTS

A free graft may be defined as that tissue which is completely severed from its tissue fluid and blood supply and transferred to another part of the body where it must establish a new and independent tissue fluid and blood supply to maintain its viability permanently (Fig. 31). The source

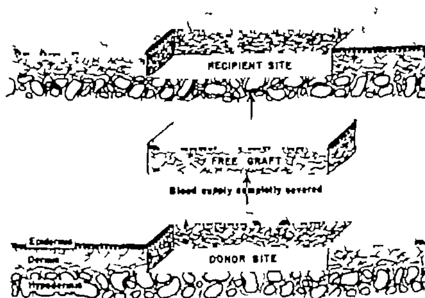


Figure 31. Free graft. Skin is the most frequently used material. Epidermis and varying amount of dermis are cut free and transferred to the new site.

of these tissues is usually the patient himself (autogenous). It has been found through long experience that the patient tolerates best his own transferred tissues. When tissues are transferred to a new site they will maintain their original characteristics. A hair-bearing free skin graft transferred to the mouth still bears hair and does not change to mucous membrane. A flap moved from the abdominal wall to the cheek also maintains its original characteristics. Thus, as more fat is deposited in the abdominal wall, similarly it will be deposited in the abdominal tissue in the cheek.

HOMOTRANSPLANTS.

The challenge in plastic surgery today is how to utilize tissues of another human being either immediately or after storage in a tissue bank. It has been possible to do this with varying degrees of success with cornea, cartilage blood (in blood transfusions) and more recently bone The success with both cornea and cartilage may be due to the fact that they are avascular have a low metabolic activity and have no blood supply of their own Transference of free skin grafts has been successful in identical twins. Actually these are autografts rather than homotransplants.

TYPES OF GRAFTS.

There are many types of free grafts, each with particular characteristics and values Grafts are obtained and transferred in one operative procedure. Sometimes if more graft is needed a secondary procedure is carried out. Long hospitalization is not as necessary as when pedicle delayed and indirect flaps are employed Grafts cannot be transferred however to avascular areas but only to well prepared beds. They do not tolerate even slight infection as well as flaps and do not always supply the necessary amount of tissue both in quantity and quality Grafts may be classified according to the four primary tissues of the body namely epithelium connective tissue muscle and nerve Those more commonly used are

1 Epithelium (and connective tissue)
   (a) Skin
   (b) Mucous membrane
   (c) Cornea
2 Connective tissue
   (a) Bone
   (b) Cartilage
   (c) Connective tissue proper
      (1) Fascia
      (2) Tendon
      (3) Derma
      (4) Fat
      (5) Blood vessels
   (d) Blood
3. Muscle
4 Nerve

(a) *Skin and Mucous Membrane Grafts* —Skin grafts are used primarily for covering or lining old or newly created raw surfaces. Skin grafts ma be classified according to thickness, size method of procurement and source They may vary in thickness from about 0.2 mm (thin) which include epidermis and relatively little dermis to about 1.0 mm., which include all of the epidermis and dermis (full thickness) but no hypodermis (Fig 32) The thick graft contracts less and is better for covering but it is more difficult to obtain a take than with a thinner graft Usually one piece of skin large enough t cover the defect is used It can be obtained either by means of a knife (Fig 33) dermatome (Fig 34) or other pecial mechanical devices.

After an excision a bare area may have to be covered by a free skin graft. Flaps which are to be placed over openings or cavities (cheek, maxillary sinus, cleft palate) should be lined with epithelium by means of either a skin graft or a flap. Skin grafts are also used to line a newly created and deepened buccal sulcus. Since a thinner graft tolerates infection better it is used in the mouth in preference to a full thickness graft. Because skin grafts maintain their original characteristics, they should be taken from areas which are relatively free of hair. Hair growing areas in the mouth

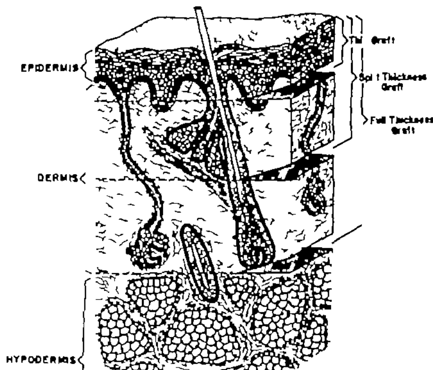


Figure 32. Skin graft classified according to thickness. The thin graft includes epidermis and relatively little dermis. The split thickness graft includes epidermis and varying amount of dermis (usually at least one-half). The full thickness graft includes all of the epidermis and dermis.

are annoying to the patient. Mucous membrane grafts are not used a great deal because of the limits of the amount of available tissue and the greater difficulty in obtaining a satisfactory graft.

(b) *Cartilage.* This is usually obtained from a rib (costal cartilage), sometimes from the ear or nose, and serves as a filling and supporting material. It is frequently used to build up deficient areas such as underdeveloped mandibles or where substance has been lost. Sometimes a portion of rib which contains both cartilage and bone is taken to replace a missing part of the mandible which includes the condyle. The cartilaginous portion is inserted into the region of the temporomandibular fossa and the bony part fixed to the remaining portion of the mandible.

(c) *Bone*.—Bone grafts are frequently used to correct deficiencies of the mandible after the removal of tumors, trauma or infection. Wherever a resection is done some provision must be made to maintain the remaining fragments of the mandible in as near proper position as possible prior to bone graft repair. If there has been disarticulation in removal of the ramus only the anterior fragment must be considered. In this case the simplest and best method of maintaining position is to wire the remaining teeth in

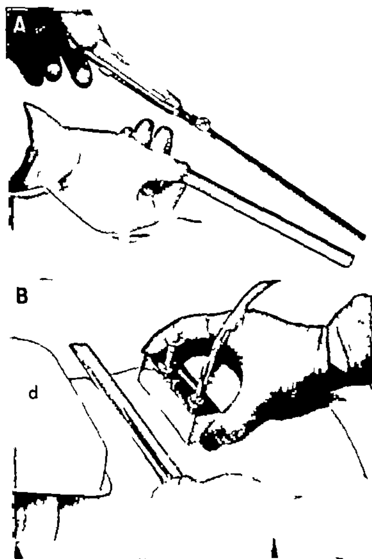


Figure 31. Skin graft [illegible] handle [illegible] form blade is inserted. *B* [illegible] *d*. Dish for counter traction.

occlusion until complete soft tissue healing has taken place. This same procedure may also be the simplest where there are teeth on both the anterior and posterior fragment. If the resection has been near the angle of the jaw, however, so that the angle and ramus remain in the posterior segment, some means must be found to maintain not only the space between fragments but also the posterior fragment in its proper position. Otherwise, as soft tissue healing occurs there will be progressive dislocation of the fragments by the pull of the various muscles and the newly forming scar tissue. This dislocation will interfere with later repair by bone graft. Dislocation by scarring is especially common where the mucosa has been removed and a granulating wound has been left inside the mouth to heal by

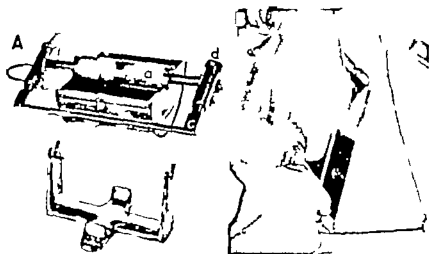


Figure 31. P dgett Hood dermatome. *A*, Component of dermatome: handle, drum mov ble ro bich conta bl k d res t adj t distance of bl le from drum t de rmine thickness of gr ft. Bel t ed for dermatome ben out use. *B*, Position of dermatome before cutting of graft. R bber cement has been pl ed on both drum and sk th t the t surf there. The mov ble arm (nt ro sterior and l la al h ached blade then brought low nd cut the kin bed the drum. A graft I inches an be obt ned.

secondary int ntion. In [illegible] rtain instances before a bone graft is applied it may be [illegible] ssary to transfer additional soft tissue by means of flaps either to repl[illegible] scar tissue or to supplement inadequate covering material which is present.

Th[illegible] b[illegible] graft [illegible] be either [illegible] using the half or full thickness of th[illegible] of the iliac crest [illegible] be th[illegible] of an osteoperiost[illegible] graft taken from the tibia. Regardless of the type of graft used it [illegible] of th[illegible] mandible with an inch or so of the bone graft where possible, making the bone graft [illegible] longer than th[illegible] left [illegible] the portion of the graft which overlaps the end of the [illegible] while the portion between the ends is thicker. In all [illegible] the bone graft [illegible] close cont[illegible] with

the mandible as possible and anchored to soft tissues or even to the bone itself with either silk or fine tantalum wire sutures.

(*d*) *Fascia*.—The fascia lata on the lateral aspect of the thigh has high tensile qualities. It is consequently used as a support of the facial tissues on the affected side in facial nerve paralysis. Fascial strips are inserted subcutaneously and attached near the corner of the mouth and the midline of the upper and lower lip. The other ends of the strips after being tightened may be attached to the temporal fascia and muscle.

ALLOPLASTIC MATERIALS.

Nonhuman materials used as implants are known as alloplastic materials. Because of the difficulty frequently encountered in obtaining human tissue, alloplastic material has been utilized. Occasionally implants from another species of animal (heterotransplants) have been attempted. Fascia, bone, cartilage, ivory, and gland are some of the substances that have been utilized. Among the non-vital materials paraffin, celluloid and more recently plastics have been used. Certain inert metals such as vitallium and tantalum have been relatively satisfactory. As each new material is reported it is greeted with undue enthusiasm and insufficient evaluation. None has been entirely successful as yet and withstood the test of time. Autogenous tissue is still the best.

There would be very definite advantages in the use of alloplastic materials. Being always available, there would be no limitation as to quantity and the material could be designed to the correct shape pre-operatively. This would save the patient additional operative procedures and shorten the operating time considerably. The disadvantages are that very few of these materials are tolerated by human tissues, particularly if the overlying tissue is subjected to trauma or motion. A foreign body reaction and infection may soon result and necessitate the removal of the substance. Experimentally in animals the plastics have produced malignancies.

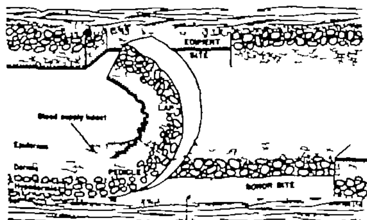


Figure 35.—Pedicle flap, supplying not only covering but filling material. Blood supply is intact at the base and the flap contains skin and also hypodermal and other tissues above the muscular fascia.

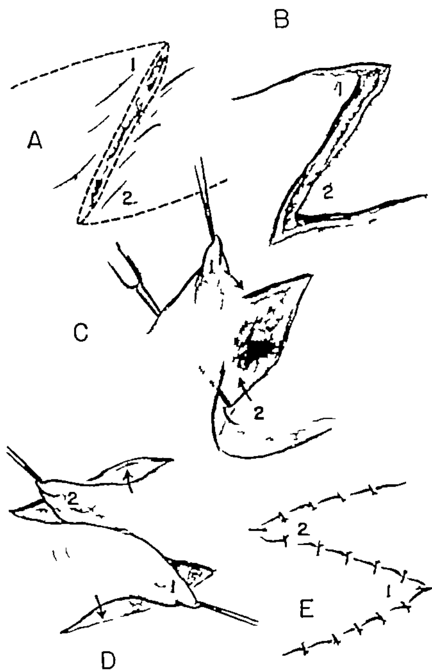


Figure 36
(Also see next page)

PEDICLE FLAPS

A pedicle flap is utilized to transfer skin (or mucous membrane) and subcutaneous tissue from one part of the body to another which is deficient in tissue. The flap must maintain an adequate blood supply at all times through its pedicle (Fig 35) Flaps can be raised almost anywhere on the body The area adjacent to the defect extremities, abdominal wall neck, and forehead are common sites. The procedure is not new and was first described many centuries ago. Only flaps from the patient can be utilized. Attempts to transfer flaps from one individual to another have consistently failed. This procedure might be successful if carried out in identical twins.

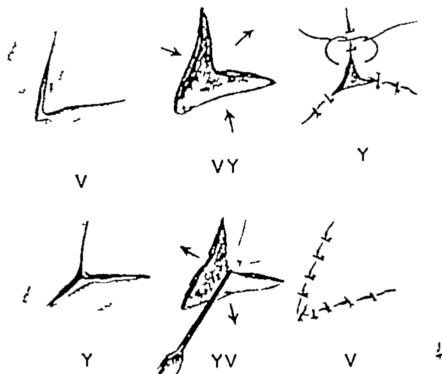


Figure 36.—VY, YV and Z procedures which are concerned with the local direct shifting of flaps. The VY procedure adds length at the expense of width to the wound. The Y-shaped wound is closed in the form of a V. The YV procedure adds width at the expense of length. The V-shaped wound is closed in the form of a Y. In the Z-plasty the incision is made in the form of the letter Z, with the common boundary of the flaps connecting the two arms. The flaps are raised, transposed and sutured in the new position, thereby reversing the Z and changing the lines of tension.

TYPES.

There are many different types of pedicle flaps. Those which have an adequate blood supply after being raised are transferred immediately. These are known as immediate flaps and are exemplified in part by the V, Y and Z procedures which are concerned with the local direct shifting of flaps (Fig. 30). Closure of defects as a V or a Y may add tissue in the area of width or length as desired. For instance, length may be gained at the expense of width if a V-shaped defect is sutured as a Y. Conversely, width may be gained at the expense of length if a Y-shaped defect is closed as a V. The Z-plasty (and its modifications) or transposition flaps is another valuable plastic surgical procedure particularly for the elimination of linear scars and changing of lines of tensions. In this method two adjacent flaps with a common boundary, the linear webbed contracted scar (which is usually excised) but with the bases on opposite sides, are raised after a Z incision, transposed and sutured in the new position. These are only some of the more common methods which utilize local flaps. There are many others of value.



borders they are sutured together. In this way the flap is completely covered by epithelium and there are no raw surfaces. This is known as a cylindrical (or satchel handle) flap. If a flap, for instance, has been raised on the abdominal wall and then transferred by several stages to another region such as the mouth or cheek, it is known as a jump flap. The arm can also be used as a carrier. This indirect transfer of a flap is in contrast to the direct transfer wherein the tissue is directly implanted into the defect.

ADVANTAGES AND DISADVANTAGES.

A flap has skin (or mucosa) as well as a thick subcutaneous layer (Fig. 3). In addition it has its own blood supply. The primary advantage of a flap is that it offers not only surface covering but also filling material for defect. Furthermore, because of its independent blood supply it can be applied to openings (oroantral) and to poorly vascularized and avascular area such as bone, cartilage and tendon. It also tends to resist infection. The disadvantages of delayed and indirect pedicle flaps are the great number of operative procedures that are necessary, the prolonged hospital stay, the uncomfortable position which the patient might have to assume and the greater number of failures which may result.

DIAGNOSIS AND TREATMENT

It is difficult to develop an entirely satisfactory classification of surgical conditions of the oral cavity and associated structures. The following classification (Table 1), although not all-inclusive and at times arbitrary, mentions the more common and important conditions that might be treated surgically or enter into the differential diagnosis, a number of which will be discussed.

TABLE 1.—A CLASSIFICATION OF ORAL LESIONS

I. Developmental lesions
  A. Soft tissue
    1. Labial pits
    2. Cleft lip
    3. Macroglossia
    4. Frena
    5. Median rhomboid glossitis
    6. Lingual thyroid
    7. Thyroglossal duct cyst
    8. Ectopic sebaceous gland (Fordyce spot)
  B. Ja
    1. Under and overdevelopment
    2. Cleft palate
    3. Torus mandibularis and palatinus
II. Inflammatory lesions
  A. Aphthous stomatitis
  B. Vincent
  C. Noma
  D. Moniliasis
  E. Pyogenic granuloma
  F. Dental infections and related condition
  G. Syphilis
  H. Actinomycosis
  I. Blastomycosis
  J. Histoplasmosis
  K. Tuberculosis
  L. Eosinophilic granuloma
  M. Sarcoidosis
  N. Sialadenitis
III. Traumatic lesions
  A. Acut
    1. Bone (fractures)
    2. Soft tissue
      a. Chemical (h I sol)
      b. Physical (lacerations, bites, thermal, radiation and electrical burns)
  B. Chronic
    1. Soft tissue
      a. Chemical
      b. Physical (denture irritation, cheek bites)
    2. Bone
      Chemical (heavy metal)
      b. Physical (radiation)
IV. Tumor and tumor-like lesions
  A. Benign
    1. Soft tissue
      a. C tic
        (1) Mucous gland
        (2) Ranula
        (3) Naso-alveolar
      b. Solid
        (1) Epithelial
          ( ) Adenoma
          (b) Pleomorphic adenoma (salivary gland mixed tumor)
          ( ) Verrua
          (d) Papilloma

(2) Non-epithelial
- ( ) Gingival enlargement
  - 1 Pregnancy
  - 2 Dilantin sodium
  - 3 Fibromatosis
  - 4 Epulis
- (*b*) Fibroma
- ( ) Hemangioma
- (*d*) Lymphangioma
- ( ) Lipoma
- (*f*) Myxoma
- (*g*) Neuroma
- (*h*) Neurofibroma

(3) Composite tumors
- ( ) Dermoid
- (*b*) Teratoma

2. Bone (Central lesions)

Non-dental origin

(1) Solid
- ( ) Fibroma
- (*b*) Ossifying fibroma
- ( ) Osteoma
- (*d*) Chondroma
- ( ) Giant cell node (local)

(2) Cystic
- ( ) Incisive canal
- (*b*) Median anterior maxillary
- ( ) Traumatic

b Dental in origin

(1) Solid
- ( ) Granuloma
- (*b*) Odontoma
- ( ) Cementoma
- (*d*) Periapical ossifying fibroma
- ( ) Ameloblastoma

(2) Cyst
- ( ) Follicular
- (*b*) Dentigerous
- ( ) Dental eruption cyst
- (*d*) Ameloblastoma
- ( ) Radicular

B Precancerous
- 1 Leukoplakia
- 2 Papilloma
- 3 Chronic ulcer
- 4 Chronic fissure

C Malignant
- 1 Epithelial in origin (carcinoma)
  - Primary
    - (1 Bowen's disease (carcinoma [illegible])
    - (2 Epidermoid carcinoma
    - (3 Adenocarcinoma
    - 4 Melanoma
  - 6 M[illegible] [illegible] prostate breast thyroid [illegible] kid[illegible] rectum
- 2 Non-epithelial in origin (sarcoma)
  - [illegible]
  - (1 Fibrosarcoma
  - (2) [illegible] [illegible]

(3) Ewing tumor
(4) Chondrosarcoma
(5) Lymphosarcoma
(6) Myxosarcoma

b. Metastatic tumors

Generalized

(1) Hodgkin disease
(2) Leukemia
(3) Multiple myeloma

V. Endocrine and metabolic lesions

A. Diabetes mellitus
B. Hyperparathyroidism
C. Pregnancy
D. Vitamin deficiency
E. Dilantin sodium
F. Blood dyscrasias
G. Lipoid dystrophies
H. Paget bone disease

VI. Dermatologic lesions

A. Lichen planus
B. Psoriasis
C. Lupus erythematosus
D. Pemphigus

VII. Allergic conditions

DEVELOPMENTAL LESIONS

Although abnormalities of the mouth found at birth may be of local origin, it is important to remember that they may be related to systemic conditions. Warkany has demonstrated that pregnant rats on a riboflavin deficient diet give birth to offspring with malformations in many areas of the body including the mouth. Any child with a malformation of the oral cavity (underdevelopment of the mandible, cleft lip, cleft palate) should be examined for other anomalies such as imperforate anus, spina bifida, hydrocephalus, syndactylism, etc.

Soft Tissue

1. *Macroglossia.*—An absent or rudimentary tongue is rare. Macroglossia or enlarged tongue however is more frequent. True macroglossia may be of a local or systemic nature. While true macroglossia is rare, relative macroglossia is not infrequently encountered in children and particularly infants. The absolute size of the tongue is not nearly so important as its size relative to the oral cavity. At birth the tongue normally is positioned between the gum pads of the jaws. Since the jaws increase in size more rapidly than the tongue, it is eventually contained within the dental arches. If there is uniform enlargement of the tongue, a wedge may be removed from the midline region. Macroglossia as a result of tumors (hemangioma, lymphangioma) usually requires surgical removal. Because the tongue is so vascular, deep sutures should be placed before the tissue is excised. These sutures can then be tied immediately not only to close the wound but also to produce hemostasis.

Frena.—A short lingual frenum limits the mobility of the tongue. Only in extreme cases (ankyloglossia) should the frenum be resected. The

common practice of cutting the frenum is to be condemned because the resulting scar tissue may make the condition worse. In many instances, with growth, the condition is self-correcting. Otherwise, a modified Z-plasty with rotation of flaps or possibly a V-Y plasty should be performed. Occasionally the combination of a bifid tongue and a short frenum with an attached tumor is seen. The tumor may consist of fibrous and glandular tissue. This can be corrected surgically at an early age by excising the medial epithelial borders, adjusting the two portions of the tongue and closure in layers.

The superior labial frenum may be more prominent than normal as relates to its thickness and extent of attachment (Fig. 37). Usually the attachment extends about midway between the upper buccal sulcus and

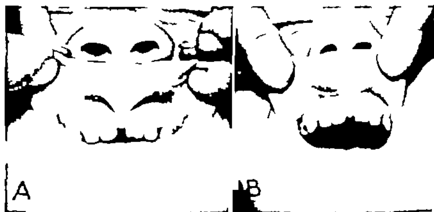


Figure 37.—Superior labial frenum. A, Pre-operative. B, Post-operative. This was corrected by means of Z-plasty.

the gingival margin. Occasionally it extends to the gingival margin and less often between the maxillary incisors to the palatal side. Associated with this may be a separation beyond the normal of the permanent maxillary incisors. As the permanent teeth erupt and the dental arch is completed the space between the upper central incisors is decreased. Resection of the frenum is seldom indicated except in the unusual case. The surgical treatment is essentially the same as that of the lingual frenum by means of a modified Z or V-Y plasty.

In addition to these developmental anomalies which may be seen at the time of or shortly after birth, others such as fibromatosis gingivae, median rhomboid glossitis, lingual thyroid and thyroglossal duct cyst are usually manifest later in life.

3. *Median Rhomboid Glossitis.* Median rhomboid glossitis is caused by a hypertrophy of an embryologic component of the tongue (*tuberculum impar*) occurring in the midline at the posterior part of the dorsum of the tongue. The result is a lesion that is small, slightly elevated, devoid of papillae [illegible] in diameter. No treatment is necessary. It is sometimes mistaken for cancer.

4 *Lingual Thyroid.*—The foramen caecum marks the site of the origin of the thyroid gland. When the gland fails to descend during embryologic development, it may be found at the base of the tongue and appears as a tumor. In about 70 per cent of patients with lingual thyroid nodules there is an absence of thyroid tissue in the neck. Because of an increase in size and the position of the tumor it may obstruct the oral pharynx. The colloid lingual thyroid has been treated by use of Lugol's solution. Surgical excision has been performed by either the intraoral or the extraoral approach. Thyroid insufficiency has followed in about 65 to 70 per cent of the cases. Iodine isotope tracer studies have been used to indicate whether a lingual mass may be aberrant thyroid tissue.

5 *Thyroglossal Duct Cyst.*—The thyroglossal duct cyst may be found anywhere from the base of the tongue at the foramen caecum to the region of the thyroid gland in the neck. This is the course followed in the development of the thyroid gland into the neck during the embryonic period. Usually the duct atrophies. When the thyroglossal duct does not completely atrophy a cystic swelling 1 to 4 centimeters in size may appear superficially in the midline of the neck, usually just below the hyoid bone. This occurs most often before puberty as a painless progressively enlarging fluctuant to soft movable mass. The cyst moves upward when the tongue is protruded or during swallowing.

An upper respiratory infection may cause it to become infected so that it may rupture spontaneously and drain. Recurring attacks of inflammation or a discharging fistula are symptoms which cause the patient to seek advice. The discharge is intermittent and slight except when activated by infection. Incision and drainage of the cyst will not result in a cure but will cause a fistulous tract to develop. The cyst and the entire tract which may go through the body of the hyoid bone must be completely dissected out to the base of the tongue.

6. *Ectopic Sebaceous Glands.*—Ectopic sebaceous glands are sometimes found in the buccal mucous membrane or vermilion border of the lips (Fordyce's spots). They appear as raised yellow areas, each about 1 mm in diameter and may be found in clusters. This is not a surgical condition. They may be unnecessarily excised by someone unacquainted with the diagnosis.

JAWS

Some of the more common developmental conditions of the jaws are (1) under and overdevelopment, (2) cleft palate and (3) torus mandibularis and palatinus.

The most important growth center of the mandible is the condyle. Total or partial absence of the condylar growth center is associated with anomalies of the temporomandibular joint and ear. The mandible and face on the affected side are smaller. In order to lessen the deformity the mandible has been positioned anteriorly by means of a sliding osteotomy of the body or ramus. Usually however masking operations by means of implanted cartilage proves to be a more satisfactory procedure. Increased activity of the condylar growth center the cause of which is unknown (except in cases of hyperpituitarism) results in a larger than normal mandible

Usually both sides are involved. Surgical treatment is directed toward retropositioning of the mandible by means of a subcondylar or trans-ramus osteotomy or ostectomy of the body.

In some patients with an underdeveloped maxilla a cleft palate is sometimes found. The cleft palate, which may be either unilateral or bilateral and either partial or complete, is frequently associated with a cleft of the upper lip. It has been reported that the trauma incident to surgical closure of the cleft palate is a contributory cause to the underdevelopment of the maxilla. Several different surgical procedures have been used to close the cleft palate. There is considerable lack of agreement, however, as to whether a cleft palate should be closed surgically and, if so, at what time and by what method.

Mention should be made of the torus mandibularis and torus palatinus. The torus mandibularis is usually found bilaterally on the lingual surface of the mandible in about the bicuspid area. Torus palatinus is found in the midline of the hard palate, usually in the posterior half. It may be as much as 3 cm. in width and length, round, oval or lobulated in shape, with a sessile or broad base. These exostoses need no treatment unless they interfere with normal function or with the construction of proper artificial dentures, or if the mucosal surface becomes traumatized, inflamed or ulcerated. When surgical removal is indicated, mucoperiosteal flaps are elevated and the bone removed by means of rongeurs and chisels. Particular care should be taken not to produce a fracture. The roughened bone should be smoothed by means of rasps and the wound irrigated to remove any loose fragments of bone. The mucoperiosteum should then be repositioned, the excess excised and the soft tissues sutured.

INFLAMMATORY LESIONS

Noma

Noma or gangrene of the mouth is rarely seen today. This condition occurs in debilitated patients. If they survive, there is usually a loss of tissue with subsequent scarring and contraction. This requires plastic surgical treatment, usually by means of skin grafts and flaps.

Pyogenic Granuloma

Pyogenic granuloma is a chronic inflammatory condition found most frequently on the gingiva but also on the tongue, lip, palate and cheek. It is an elevated, lobulated, ulcerated purplish-red tumor-like mass which bleeds readily upon slight trauma. Therapy should be directed toward removal of possible local irritating factors. The lesion itself may be excised or destroyed by means of electro-cautery. Even after apparently complete removal or destruction the condition may recur.

Dental Infections and Related Conditions

Oral and facial abscesses are usually secondary to infections of the teeth and jaws. Infections of the skin are initiated by the introduction of pathogenic organisms into the openings of hair follicles and glands. In the mouth pathogenic organisms are introduced to the jaws through the separa-

tion between the gingiva and the teeth (lateral abscess) or as a result of dental caries with infection and death of the pulp with a spread to the root end region (periapical abscess and osteomyelitis). The direction of spread (intraoral or extraoral) of the abscess will depend upon the particular location in the upper or lower jaw of the tooth roots and their relationship to muscle and fascial planes. The acute phase may extend into a chronic one characterized by a formation of a periapical dental granuloma, cyst, abscess or chronic draining sinuses opening into the mouth or onto the face or neck. A patient with a chronic sinus (draining or not) of the skin of the face or neck should be examined to see whether a dental infection is the possible source.

Osteomyelitis of the jaws is more often a result of local rather than systemic factors. The acute type is frequently secondary to infection of the dental pulp but may also result from a retained dental root or fractures of the jaws. Although the acute type may become chronic, the latter is more commonly associated with secondarily infected cysts, heavy metal poisoning, various radiations, tuberculosis, syphilis and actinomycosis. In chronic osteomyelitis there may be acute recurrent exacerbations. In the presence of teeth the periodontal structures serve as a pathway for the spread of infection. Seldom does osteomyelitis begin in the edentulous jaw.

In the acute stage of osteomyelitis, roentgenographic evidence may not be found during the first few weeks. In the chronic stage, however, destruction of bone may be seen in the roentgenogram. Malignancies of the bone also show evidence of destruction on the roentgenogram and should be considered in the differential diagnosis.

Treatment should be directed toward prevention and elimination of the etiologic agent. Proper dental care will decrease the frequency of pulpitis and periapical infection. Patients who are administered heavy metals or radiation particularly in the mouth should receive excellent oral care including removal of teeth with pathologic changes which might give rise to complications. The judicious prophylactic and therapeutic use of the indicated antibiotics or chemotherapeutic agents have been of inestimable value. However, there is no substitute for surgical treatment. Local treatment includes (1) drainage, (2) removal of non-vital tissue and (3) subsequent plastic surgical procedures for reconstruction of the residual deformity. Abscesses must be incised and drained. Planning of the incision is important as pertains to adequate drainage, avoidance of important structures and an inconspicuous scar, especially around the face. The underlying tissues are spread by blunt dissection to the source of the infection, which is usually at the bone. Infected roots, sequestra and foreign bodies should be removed. A small rubber drain is inserted. Sometimes a deep-seated abscess with overlying indurated tissue will not be fluctuant. Nevertheless, incision and drainage is indicated.

SIALADENITIS.

Suppuration of the salivary gland may be acute or chronic. The acute type is found most frequently in the parotid gland of debilitated patient. The onset is sudden, the gland becomes swollen and hard, and pressure on the facial nerve may cause a palsy. Fluctuation may not be obtained be-

cause of the toughness of the parotid fascia. The papilla of the opening of the parotid duct is swollen and red and a thick purulent discharge can be noted To produce the latter slight pressure on the parotid gland may be necessary The appropriate antibiotics should be administered. If incision and drainage are necessary a vertical skin incision should be made along the anterior border of the external ear The anterior border of the wound is retracted and by blunt dissection in a horizontal plane in order to avoid the facial nerve entrance is gained into the gland through the capsule. Drains are inserted the wound closed in part and a pressure dressing applied.

Chronic suppuration is found most frequently in the submaxillary salivary gland This is usually found associated with calculi or mucous plugs within the gland duct or both Depending upon the size location and number of calculi, partial or complete obstruction of salivary outflow may occur *Swelling and pain in the gland and surrounding area occur* at mealtimes because of the accumulation of the increased amount of saliva produced Where possible stones in the duct should be removed intraorally Sometimes with smaller stones dilatation of the duct may aid their being expelled With removal of the obstruction to salivary flow the infection will usually subside When the calculi are within the gland it may have to be extirpated by the extraoral submaxillary route

TRAUMATIC LESIONS

ACUTE LESIONS.

Fractures of Bone —(a) *Facial Fractures* — Acute or chronic trauma may produce lesions of the soft tissues and or jaws. Injuries of this region are of more than ordinary significance since if they are not properly treated at the time of infliction they are apt to leave deforming scars and serious functional impairment. Subsequent treatment may require multiple plastic surgical procedures, after which the final result may still leave much to be desired

Sudden external forces to the face as a result of a vehicular accident fist blow missile or fall may cause fractures involving the mandible maxilla zygoma nasal and other facial bones. Diagnosis and treatment of a facial bone fracture is as much of an emergency as a fracture of a long bone When a jaw fracture is sustained the teeth and supporting structures are also frequently involved and the organisms in the oral cavity gain access through the torn mucous membrane to the site of fracture Consequently jaw fractures involving the teeth are compound fractures. The most common cause of mandibular fracture is probably fist blows. Children who fall from a bicycle or porch may sustain a broken jaw Occasionally during extraction of lower third molar the mandible is fractured Fractures also occur where pathologic processes are present in bone Thus the etiologic agent may be in local conditions a cyst neoplasm or osteomyelitis or in a systemic condition, hyperparathyroidism.

The signs and symptoms of a fracture are deformity malocclusion, pain, anesthesia paresthesia hemorrhage abnormal mobility trismus, and

swelling Roentgenographs of the entire mandible, maxilla and other facial bones should be taken lest an unsuspected fracture be missed The x-ray picture is invaluable as relates to the site direction comminution and number of fractures. It is, however of little value as pertains to the stage or degree of healing

Before treating a patient with a facial injury it is important to remember that he must be in satisfactory general condition and able to withstand the surgical procedure One must determine immediately whether anything is obstructing the trachea whether there is active hemorrhage and whether the patient might be in shock. Injuries to the skull cervical spine chest, or viscera must also be considered

Specifically however treatment of the fracture resolves itself into bringing the fragments back into normal position as soon as possible. Dental occlusion and lack of deformity are our guides. Most of these fractures can be treated by closed manual reduction Sometimes in order to get satisfactory reduction of the fragments, it is necessary to expose the fracture site In jaw fractures the fragments are maintained in position by dental fixation and wiring of the jaws or by skeletal fixation wherein the bone itself is utilized Sometimes a combination of both dental and skeletal fixation is used

There are a number of ways of wiring the teeth and jaws together The Ivy loop method is a popular one A looped wire is passed between two teeth and then brought around the necks of these teeth on the lingual through the interproximal spaces to the buccal surface One end of the wire is passed through the loop and they are twisted together A third or intermaxillary wire is passed through the loops of the upper and lower wires and in this way the jaws are fixed in occlusion Sometimes intermaxillary elastics may be substituted. Arch bars are also frequently used.

The skeletal methods of fixation are used most often in edentulous areas. Circumferential wiring of the lower artificial denture or of a splint to the mandible Kirschner wires and internal wiring are methods of skeletal fixation.

In maxillary fractures the jaws are wired together in occlusion and fixed by means of subcutaneous wires to the skull (infraorbital plate of bone zygomatic arch etc) Zygomatic fractures may be reduced and fixed by the intra or extraoral route. Fractures of the nasal bones are usually reduced through the endonasal route Intra- and extra-nasal pressure dressings are then applied

Post-operative care is concerned with diet, oral hygiene the appliance and control of infection When the jaws are wired together it is important to see that the patient obtains an adequate diet in terms of consistency calories and essential foodstuffs. Addition of calcium and vitamin D to an adequate diet will not cause the fracture to heal any more rapidly Intermaxillary fixation should be removed if the patient is going to vomit.

In order to carry out the technical aspects intelligently in the treatment of fractures it is essential to have an appreciation of the biology of healing The healing of the fractured facial bone is generally similar to that of bones in other parts of the body From the time of the fracture until the final

healing of bone untoward events may occur which will delay healing Causes are displacement mobility at the site of fracture often leading to the persistence of the fibrocartilaginous callus interposition of foreign tissue particularly muscle comminution of bone and infection.

(b) *Oro-antral Fistula* —Sometimes, as a result of the extraction of a maxillary bicuspid or molar (and bony floor of sinus) a permanent communication between the mouth and the maxillary sinus (oro-antral) is established Closure of this opening is obtained by rotating a local flap either from the palate or buccal mucosa. The flap must be of sufficient size so that its margins rest on the bone some distance beyond the opening

Soft Tissue Injuries —The same force which produces a facial fracture may also cause widespread injury to the oral and facial soft tissues in the form of contusion, laceration avulsion, and introduction of foreign material Because the lips and cheeks are sometimes severely impressed against the teeth *deep irregular lacerations in these areas may also be sustained* Bleeding should be controlled. Early primary repair where possible is essential The wound should be cleansed by gentle irrigation with a warm normal saline solution All accessible debris, including broken teeth glass and dirt should be removed to decrease the possibility of infection and an unsightly tattoo Every effort should be made to preserve as much of the damaged but viable tissue Irregular margins may be trimmed minimally The wounds are closed in layers. Drainage is seldom necessary if good hemostasis has been obtained A properly applied pressure dressing will facilitate healing Antibiotics and tetanus antitoxin or a booster should be administered

The force producing acute injuries may be applied not only extra-orally but also intra-orally Damage to the palate occurs with children who fall on a pencil or stick candy which is in the mouth Usually small puncture wounds heal requiring no care other than cleansing Even soft tissue tears completely through the soft palate will usually heal spontaneously If satisfactory closure does not occur the deformity can be corrected subsequently when conditions and the patient are better controlled Larger palatal wounds however had probably better be closed primarily

Occasionally the dentist will accidentally injure the mouth with a bur disc or chisel Attempted suicide by firing a gun with the nozzle held inside the mouth will destroy and distort the soft and hard tissues. The effects will vary with the initial position of the gun the kickback, the size of the bullet and its final pathway Electrical burns of the mouth in young children who bite into wires are no longer a frequent occurrence. In this condition as well as in lye and Lysol burns of the mouth there can be considerable loss of mucous membrane The same may be true after surgical excision or cautery destruction of lesions of the buccal mucosa. A V Y or Z plasty may be of some help in correcting the subsequent scarring and contraction of these wounds. Expansion of the wound and application of a skin graft or flap is frequently required

During a convulsion (epilepsy eclampsia) the cheek, tongue or lip may be accidentally bitten Prevention of the injury can be accomplished by inserting thickly rolled gauze pads between the jaws. Small wounds require no treatment If they are deep gaping or bleeding they can be

sutured. The tongue, lip and face can sustain a loss of tissue when bitten by another person or by an animal, particularly the dog. These bites require careful operative and post-operative care. The wounds should be thoroughly and copiously irrigated with warm normal saline solution and administration of antibiotics should be instituted immediately. Complete closure of the wound may not always be advisable. Final correction can be done secondarily. The animal should always be observed to determine whether it might be rabid.

CHRONIC LESIONS.

Although the oral tissues are subjected to almost constant irritation by physical and chemical agents, serious sequelæ are relatively uncommon. The resulting inflammatory reactions are usually destructive in nature. Hyperemia, edema and ulceration frequently occur. The tissue may also become hypertrophic, hyperplastic or hyperkeratotic. The lesion will vary according to not only the nature, duration and intensity of the irritant but also the reaction of the local tissues. In Table ? most of the factors

TABLE 2.—PHYSICAL AND CHEMICAL CAUSES OF ORAL LESIONS

A. Physical
  1. Bites
    a. Accidental
    b. Habitual
    c. Convulsive (epilepsy, eclampsia, et)
  2. Blows
    a. Animate
    b. Inanimate
  3. Falls
  4. Poor oral hygiene
    a. Rough teeth
    b. Dental caries and calculus
    c. Rough dental restorations
      (1) Fillings
      (2) Clasps
      (3) Dentures
  5. Foreign bodies
    a. Coarse food
    b. Toys
       Occupational agents
      (1) Intentionally introduced (tacks, nails, pins)
      (2) Unintentionally introduced (sand and other irritants)
    d. Missiles
  6. Thermal agents (extremes of heat or cold, particularly in foods)
  7. Electrical
       Electro-galvanic (dissimilar metals in fillings)
    b. Biting of electric wires
  8. Radiation (X, gamma, et)
  9. Surgical treatment
B. Chemical
  1. Dentifrices and mouthwashes
  2. Alcohol
  3. Tobacco and tobacco products
  4. Corrosives and caustics (hydrochloric and other acids, Lysol, sodium hydroxide, tincture of iodine, silver nitrate, aspirin, et)

are listed Proper treatment requires the discovery and removal of the etiologic agent After this has been done the lesion will frequently disappear without further treatment other than proper oral hygiene Occasionally excision or electrocautery destruction of the proliferative tissue is necessary

Some patients are in the habit, particularly when under nervous tension to suck the buccal mucosa between the maxillary and mandibular teeth and chew on it This results in superficial ulceration and scarring Removal of the cause will permit the lesion to heal.

The chronic irritation of the gingivae of the alveolar ridge or buccal sulcus by a poorly-fitting artificial denture provokes a hyperplasia of the tissue. This same response occurs when there is a lack of adaptation of the upper artificial denture to the palate Removal of the prosthesis for several weeks will permit the hyperplastic tissue (granuloma fissuratum) to shrink either considerably or completely Excision of the remaining excessive tissue and accurate approximation with sutures is then less of a problem It is important when excising the many folds of hyperplastic tissue to preserve the buccal or labial sulcus so that a well adapted artificial denture can be constructed

For example a satisfactory artificial lower denture cannot be made for a patient because of a deficient gingival labiobuccal sulcus, as a result of resorption of alveolar bone trauma, necrosis or burns. One method whereby the sulcus can be deepened is by incising the desired amount and covering the raw surfaces with a skin graft to prevent them from healing together The method is basically the same with minor variations, as that used in the other previously mentioned problems.

The procedure is as follows A relatively hairless thin skin graft is first obtained from the inner surface of the arm If the graft is too thin, it will shrink considerably after it has been transplanted On the other hand if it is too thick the problem arises of obtaining a take in the mouth The size of the graft cut should be in excess of the amount expected to be required The purpose in cutting the skin graft first is to avoid contamination of the donor site If the oral wound is prepared first a sterile noncontaminated surgical team should cut the graft. A horizontal incision is then made, parallel to the alveolar ridge in the area of the gingival labial-buccal sulcus. The incision should be extended beyond the region deficient in the sulcus. The tissue should be incised to a depth somewhat greater than the desired depth of the sulcus After complete hemostasis has been obtained a piece of dental modeling compound softened in hot water is inserted into the cavity and an accurate impression of the defect is obtained The mold is then removed after it has cooled and hardened and the upper part trimmed so that the superior soft tissue margins of the defect can be nearly approximated over it The mold is re-inserted for a final check and removed Black silk sutures are inserted across the wound margins preparatory to closure The skin graft is then wrapped completely around the mold with the raw surface facing outward. Surgical mechanic's waste wrapped in grease gauze can sometimes be substituted for the dental modeling compound The skin-covered mold is then carefully inserted into the prepared wound and the black silk sutures tied, thus sealing it

under the proper tension and fixation All of the principles of skin grafting must be followed carefully In addition, the problem of oral contamination is to be considered Antibiotic therapy pre- and post-operatively i indicated After about six to ten days the sutures are cut the wound opened and the mold carefully removed The wound is cleansed and the mold may be re-inserted Sometimes in an attempt to avoid undue contraction of the grafted wound a prosthesis is inserted for two to three months. It is removed daily to be cleansed On occasi n an additional graft may be necessary

TUMOR AND TUMOR LIKE LESIONS

Since cancer is the most important diagnosis to rule out any lesion should be considered to be such until proven otherwise On this basis all of the lesions found within the oral cavity and on the face or associated with these areas, which must be considered in the differential diagnosis, can be classified into the following three groups (1) noncancerous, (2) precancerous and (3) cancerous lesions.

In addition to the tumors found elsewhere, in the oral cavity there are also specific tumors arising from the tooth forming organs. Thus, two types are found (1) those which are dental in origin and (2) those which are nondental in origin It is of interest to note that tumors which are dental in origin are rarely malignant

Noncancerous Lesions.

A benign neoplasm is characterized by its slow growth A limiting connective tissue capsule is present. The growth does not infiltrate locally and it does not spread to a distant region A benign tum r may cause death of the host however if it interferes with a vital function as in the case of pressure on the brain, trachea or a major blood vessel Benign neoplasms and tumor-like lesions of the oral cavity can be conveniently grouped into (1) those related to soft tissue and (2) those related to bone (Table 1)

1 Soft Tissue.—(a) *Cystic* —The benign soft tissue lesions are principally solid (epithelial and connective tissue) except for those cysts which arise from mucous glands particularly from the mucous membrane at the floor of the mouth cheek and lip After reaching a certain size these cysts will rupture spontaneously and tend to disappear temporarily only t return after the opening has closed If the cyst can be marsupialized so that it communicates permanently with the oral cavity no further treatment is necessary Complete excision of the cyst where possible is the preferred method of treatment The defect left in the deep tissues after removal of the cyst must be closed so that there is no dead space The tissues must also be adjusted to minimize an possil le deformity Sometimes if the cyst is so large that satisf ctory excision nd closure is not feasible the cyst may be incised and permitted to collapse At a later date when the cyst re-forms and i still small, it may be excised

(b) *Solid* —(1) *Epithelial Neoplasm* —A benign epithelial neoplasm such as the papilloma is described under precancerous lesions. Th adenomas are not common. The mixed tumor or pleomorphic adenoma

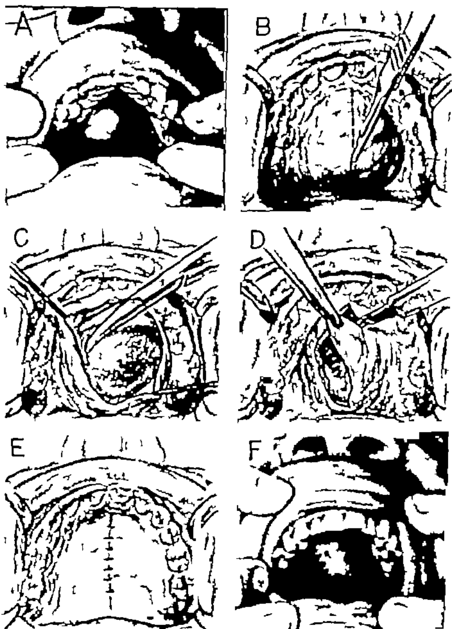


Figure 38 — Mixed tumor of palate. *A*, Pre-operative view. *B*, Line of incision. *C*, Reflection of mucoperiosteal flaps and dissection of tumor mass outside its capsule. *D*, Tumor mass removed completely and mucoperiosteal flaps adapted to the concavity instead of the previous convexity. Excess tissue being excised. *E*, Mucoperiosteal flaps repositioned against hard palate and the borders sutured. *F*, Post-operative view.

may occur in the parotid salivary gland the submaxillary salivary gland the palate (Fig 37) lip cheek or tongue. There is much confusion concerning the composition of this tumor It may sometimes become malignant. The dissection which should be done external to the capsule must be complete. The space left after removal of the mass should be eliminated and a drain inserted if necessary In parotid tumors the facial nerve should be preserved

( ) *Connective Tissue Neoplasms* —The benign connective tissue tumors may occur wherever the particular tissue of origin is present. Treatment of these lesions is similar to that for those found on the skin or elsewhere

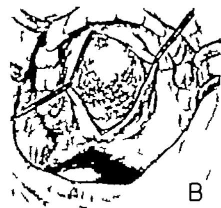
Hyperplasia of the epithelium of the gingiva and subepithelial connective tissue is sometimes found in pregnant patients and those taking dilantin sodium. Fibromatosis gingivae of the congenital type is characterized by a persistent hypertrophy of the gingival tissues, which may be associated with hypertrichosis. Because of the enlarged gingiva few teeth are visible In order to improve dental function and esthetics all of the hypertrophied gingival tissue is excised down to the periosteum of the alveolar bone exposing the crowns of the teeth completely The removal is done as thoroughly as possible with knife dissection Bleeding is controlled and the raw areas allowed to heal spontaneously The tissue is sometimes prone to recur In order to effect a permanent cure a more radical approach has been followed removing not only all of the excess gingival tissue but also extracting all of the teeth. Radiation therapy is not advised All of these conditions must be differentiated from the enlarged gingiva seen in leukemia.

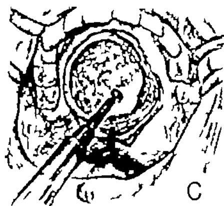
In addition to general enlargement of the gingiva local areas of growth are also seen The nonspecific term of epulis has been applied to individual growths of the gingiva. On histologic examination they may be found to vary in structure, containing giant cells (peripheral giant cell tumor) and fibrous, vascular or other tissue The mass should be completely destroyed by means of surgical excision or electrocautery These growths frequently arise from the periodontal membrane In such cases it is sometimes also necessary to extract the adjacent teeth A dental x-ray picture may give an indication as to whether the bone is involved

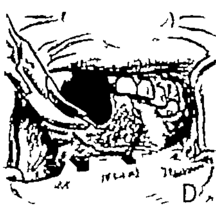
(3) *Composite Tumors* —The composite tumors consist of tissues from more than one germ layer The dermoid which is not a common tumor is an example It is seen most often in the midline in the floor of the mouth either below or above the mylohyoid muscle If the mass is above the mylohyoid muscle it can be removed intra-orally If the mass is below the mylohyoid muscle it should be removed extra-orally through a submental incision.

2. BONE.—(a) *Non-dental in Origin* —(1) *Solid Lesions* —The central benign lesions of the jaws are similar to those found in bone elsewhere in the body The central giant cell type however may be either monostotic or polyostotic in nature Treatment of the single lesion may be conservative by thorough local surgical removal and or radiation therapy (Fig. 39) In multiple lesions, if the patient has hyperparathyroidism related to a parathyroid adenoma, the adenoma should be removed











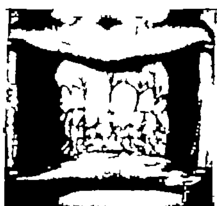


Figure 30.—Benign giant cell tumor of hard palate in an eleven-year-old boy. The diagnosis was confirmed by microscopic examination of biopsy specimen. *A* Photograph of palatal region. *B* Exposure of tumor mass by reflection of the tissue flaps. *C* The bulk of the tumor mass, which was quite friable, has been removed by means of scalpel and curettes. That which remains is being destroyed by means of electrocautery. *D* The hard palate had been invaded and partly destroyed by the tumor mass. The remaining bone is being removed by means of rongeur. A communication has been established between the oral and nasal cavities. Because the tumor mass had invaded the alveolar bone all the teeth and alveolar bone in that quadrant were removed, except the unerupted third molar. *E* Oral condition of patient one month after local removal of the benign giant cell tumor. *F* Prosthesis in place.

(*c*) *Cystic Lesions*.—The nondental bone cysts are found most frequently in the maxilla and are located in regions of fusion of the palatal processes (Table 1). The traumatic cyst, a result of trauma, is found in the mandible. It has no epithelial lining and the cavity may be empty or filled with the degradation products of blood. The diagnosis is usually made at the time of operation.

(*b*) *Dental in Origin*.—In addition, a group of tumor and tumor-like lesions which are dental in origin are also found within the jaws. They may be grouped into the solid type (ameloblastoma, odontoma and cementoma) and the cystic type (follicular, dentigerous, radicular cysts, and the cystic ameloblastoma). None of these ever becomes malignant with the possible but rare exception of the ameloblastoma.

1. SOLID LESIONS.—(*a*) *Odontoma*.—The odontoma may contain from one to many irregular calcified bodies which are composed of enamel, dentin and cementum arranged in bizarre patterns. This tumor, which is actually a secretory product, develops when the tooth-forming organs are active and its growth stops with the cessation of activity of the formative cells. Clinically, many of these growths are first found during routine roentgenographic examinations. The outline of the odontoma and its components may be seen on the roentgenograms. The most direct and best approach to remove an odontoma consists of laying back a buccal or labial mucoperiosteal flap and chiseling away the overlying plate of bone. The base of the flap should be directed toward the gingivo-buccal fold and should be large enough to extend beyond the limits from which bone is to be removed. The cavity left after removal of the odontoma can be allowed to be filled with blood and the flap reapplied for complete closure of the wound.

(*b*) *Ameloblastoma*.—The ameloblastoma is derived from the cells of the odontogenic epithelium (dental lamina, enamel organ). It is found most frequently in the mandible and much less in the maxilla. The ameloblastoma is a benign neoplasm which seldom becomes truly malignant and metastasizes. A better known characteristic of this tumor is its persistence and tendency to recur after operative intervention, probably because of the small peripheral buds which are missed in the bone marrow spaces. The ameloblastoma, which is most frequently seen in young adults, is characterized by a slow progressive swelling, usually near the angle of the mandible. There is frequently a history of removal of one or more teeth from the area and of repeated surgical attempts to remove the tumor. Secondary infection of the tumor and fistulous tract leading to the oral cavity or skin are not uncommon complications. The roentgenogram serves as a valuable adjunct in the diagnosis of radiolucent lesions of the jaw. Th[illegible] — [illegible] however [illegible] n the grow and particularly the [illegible] tgenogram is most valuable for the [illegible] of the jaw where the tumor is still centrally located and in the solid phase and has not yet led to an increase in the size of the bone. At this time most of the mandible is not destroyed and the tumor can still be completely removed without serious deformity. When the ameloblastoma has become cystic and consider

ably larger the clinical findings are obvious and the roentgenogram is of primary value in showing the extent of bone destruction.

Curettement, cauterization with chemicals and radiation are inadequate therapeutic measures. The lesion should be completely enucleated if unilocular or if more extensive, resected with a small amount of normal bone.

7 CYSTIC LESIONS —(a) *Follicular and Dentigerous Cysts* —The follicular cyst is a result of the cystic degeneration of the tooth germ When the crown of a tooth is included within the cyst, it is known as a dentigerous cyst. These are usually discovered first on routine roentgenographic examination Treatment consists in laying back a mucoperiosteal flap in the area and exposing the thin layer of bone which is removed by means of a chisel or rongeur The cyst wall is incised and the fluid contents (clear or purulent) aspirated If an unerupted tooth is present it is extracted The cyst wall is then separated from its bony wall and removed completely The cavity is allowed to fill with blood and the mucoperiosteal flap repositioned When the cavity is too large or infected it may be packed rather than closed primarily This procedure can also be followed in order to preserve the unerupted tooth which may subsequently erupt and become functional

(b) *Radicular Cyst* —The radicular cyst is environmental rather than developmental in origin and occurs at the root end of the adult tooth The pathologic process is that of caries of the enamel and dentin with subsequent exposure and death of the dental pulp This infection spreads to the root end of the tooth and eventually causes the formation of a granuloma. Sometimes the granuloma undergoes cystic change to form a root end cyst which may become secondarily infected and eventually drain. On the roentgenogram both the periapical granuloma and root end (radicular) cyst appear radiolucent and one is not always able to distinguish between them

PRECANCEROUS LESIONS

The term 'precancerous' must be used with certain qualifications. It is well known that cancer of the mouth is sometimes found associated with leukoplakia papillomas chronic ulcers and fissures. The atrophic mucosa of the oral cavity and pharynx associated with Plummer Vinson syndrome and vitamin B deficiency is also predisposed to cancer In the cancer susceptible patient these lesions after adequate irritation, may undergo malignant change Not all however will become cancer so that to use the term precancerous may be condemning a benign lesion It is impossible to determine which of the precancerous lesions will remain benign and which will become malignant. Therefore it is good practice to remove at once for microscopic examination those apparently benign lesions which are subjected to chronic irritation or which show signs of change

(1) *Leukoplakia* Leukoplakia a chronic whitish lesion, is found on the buccal mucosa, palate and tongue It has also been found on the vermilion zone of the lips and elsewhere on the mucous membrane of the mouth pharynx and esophagus. Not all white lesions, however are leukoplakia Hyperkeratosis lichen planus moniliasis, the mucous patch and areas

exposed to chemical and physical agents may also have the appearance of white patches.

Leukoplakia may occur either as a single small spot or cover large areas such as the entire dorsal surface of the tongue. Its borders are usually irregular. The consistency and color of the surface may vary from one which is quite thin, smooth and barely palpable and bluish-white (Grade I) to one which is quite thick, leathery, ridged, warty, and yellow white (Grade IV). In this latter type chronic fissures or ulcers are sometimes seen. If the lesion is small enough it can be completely excised and examined microscopically for possible malignant change. Larger suspected lesions can be biopsied before treatment is instituted. Excision with direct closure or application of a skin graft or electrocautery destruction are accepted methods of treatment.

The majority of cases of leukoplakia probably do not develop into cancer. Epidermoid carcinoma, however, is sometimes found in its vicinity. Patients with leukoplakia should be warned of the possible danger. Any patients with leukoplakia should be checked for the four "S's": (1) smoke, (2) spirits, (3) spices, (4) syphilis. They should discontinue the use of all oral irritants such as tobacco, alcoholic beverages, highly seasoned and hot foods, and should report for periodic check ups. The diet should be supplemented with vitamins, if necessary, particularly vitamin B complex and possibly vitamin A. If the patient is found to have syphilis, specific treatment should be instituted, especially since luetic glossitis, leukoplakia and carcinoma of the tongue are frequently found associated with each other.

( ) *Papilloma*.—The papilloma occurs on either the tongue or mucosal surface of the mouth. When subjected to trauma during mastication and speech and while still benign, it is a relatively simple surgical procedure to remove the papilloma. Such early treatment is strongly recommended.

(3) *Chronic Ulcer*.—The chronic ulcer, particularly on a traumatic basis, should also be considered as a precancerous lesion. A rough tooth or dental appliance may be the irritating factor causing the ulcer. Usually after the causative agent is removed the ulcer heals. If, however, the ulcer does not heal or show definite signs of healing within one to two weeks, the lesion should be considered to be cancerous until proven otherwise.

CANCEROUS LESIONS.

A malignant neoplasm may be defined as one in which cellular growth is uncontrolled. A limiting capsule is absent. The growth infiltrates locally but may metastasize to a distant region and eventually cause the death of the host (Fig. 40).

Although oral malignancies have been reported at birth, they are seldom found before the fourth decade, the majority occurring in the fifth to seventh decades. Epidermoid carcinoma is the most common lesion and it occurs predominantly in the male. The etiology of oral cancer must be considered on the same basis as that in the rest of the body. The occurrence of carcinoma of the mouth in association with leukoplakia, avitaminosis B, Plummer-Vinson syndrome and syphilis is known. Chronic irritation as a result of smoking, rough teeth or dental restorations or

biting may sometimes be an irritating factor. Surely wherever possible these conditions should be corrected even if only to improve oral hygiene.

(1) *Carcinoma.*—These malignant epithelial neoplasms arise locally either from the stratified squamous epithelium of the oral mucous membrane or from the glandular elements. The adenocarcinoma is found most often in the parotid and the palatal glands. The most malignant of all tumors is the melanoma which grows rapidly and metastasizes early. It is coal black in appearance. It may be seen on the gingiva or the buccal mucosa.



Figure 40.—Diagram of histogenesis of a carcinoma correlated with gross clinical findings. *A* Normal. *B* Subclinical stage (incipiency—carcinoma *in situ*). *C* Early clinical stage (nodule). *D* Advanced clinical stage (ulcer). *E* Far advanced clinical stage (metastasis).

Some secondary oral carcinomas have metastasized from a primary lesion in a distant organ. Thus, carcinoma of the prostate, thyroid, kidney, breast, rectum and lung have a tendency to metastasize to bones and may *therefore metastasize* also to the jaws. The histologic picture of the primary growth is often duplicated in the metastatic lesions. These secondary

tumors, because they are metastatic are usually located within the center of the jaw. Diagnosis of the primary tumor is sometimes made only after histologic examination of the metastatic lesion.

(2) *Sarcoma.*—These malignant nonepithelial neoplasms arise from the more deeply situated tissues of the oral cavity and adjacent structures. Most sarcomas arise from the tissues of the bones. Consequently, the tumors are frequently centrally located within a bone and lead to its enlargement. This enlargement results from destruction of the bone from within and apposition of new bone on the outer surface and leads to

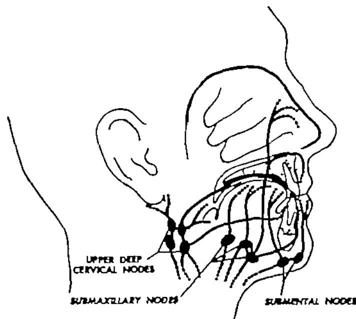


Figure 41.—Regional lymph nodes and lymph vessels of the deep structures of the mouth and face.

asymmetry of the part. Because of pressure on nearby nerves, pain may be one of the earlier complaints. Sarcomas usually occur in the younger age groups (first to fourth decade). They grow rapidly and as a rule the prognosis is poor. Occasionally a sarcoma in some remote part of the body, such as the femur, may metastasize to the jaws. Consequently one must be on guard not to miss this possibility. Leukemia is sometimes considered to be a sarcoma of the blood forming organs. In leukemia the gingiva may be enlarged and show characteristic changes which at times constitute one of the earliest diagnostic signs.

(3) *General Principles of Surgical Treatment.* The method by which surgery accomplishes its purpose [illegible]. It requires either the complete removal or destruction of all of the cancer cells. This may be done by means of excision by use of the cold steel or electro-knife, rongeurs and saws, or by means of electro- or thermal destruction of the growth. Treatment can

be accomplished both more readily and more satisfactorily when the growth is small and localized. When the growth is large and has spread either locally or to a distant source complete removal is more difficult and less successful. To insure complete removal of cancer it is necessary to remove a certain amount of normal tissue beyond which, on the basis of clinical judgment, it is believed the cancer has not spread. Cancer surgery must be radical surgery. If a single cancer cell remains, it will continue to grow



Figure 42.—Incisions for complete unilateral neck dissection. Horizontal incision extends from the mastoid process to opposite side of the chin and passes about 3 cm. below the angle of the mandible. Vertical incision extends from the middle of the horizontal one beyond the clavicular insertion of the sternocleidomastoid muscle.

and multiply and the treatment is a failure. If the surgeon does not eliminate the cancer, the cancer will eliminate the patient. It is far better to have a permanent recovery with some impairment than to have an immediate good cosmetic result followed by an early death.

Surgical treatment is required not only of the primary oral lesion but also of the cancer which has spread beyond the oral cavity. Because carcinoma travels through the lymphatics (Fig. 41), surgical procedures have been devised to remove these tissues. Consequently, a neck dissection, a procedure whereby all cancer-bearing tissue originating from either the

mouth or face is removed may sometimes be a more formidable procedure than the local removal of the primary lesion

Cancer of the lip and skin of the face spreads to the neck late and infrequently Because the metastases from the lip are usually limited to the upper neck, sometimes in both submental and submaxillary areas a bilateral suprahyoid neck dissection may be performed Because cancer of the floor of the mouth tongue and tonsil tend to spread to the neck earlier more frequently and more extensively than cancer of the lip more neck dissections are necessary with such lesions. The complete unilateral (Fig 42) and occasionally a complete bilateral neck dissection will be required There is no unanimity of opinion concerning the time of and the indication for neck dissection

SUMMARY

The diagnosis and surgical treatment of the lesions of the oral mucosa are essentially the same as that of the skin. The principal differences, however between the skin and the oral cavity are in the diagnosis and treatment of the lesions of the jaws, associated in particular with the developing and adult tooth and its supporting apparatus. The same general surgical principles, with certain variations, must be observed in regard to pre-operative, operative and post-operative care The ultimate goal is to obtain as near normal function and appearance Frequently to attain this goal various plastic surgical procedures are essential either at the time of the initial or at subsequent operations.

Figures 31 32, 33, 34, 35, 40, 41 42, re borrowed from *Oral and Facial C ncer* I Bernard G Sarnat and Isaac Schour and are published by permission of the Yearbook Publishers Inc Chicago, Illinois.

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6

The Surgical Treatment of Advanced Visible Cancer

Robert S Pollack M.D

DESPITE their readily visible nature and the ease with which they may be diagnosed it is estimated that over half of the patients with visible tumors are seen for definitive treatment in an advanced or moderately advanced *stage of their disease This is especially so for cancers of the oral* cavity where delay in diagnosis is notorious. Early biopsy often means the difference between success and failure The earlier a diagnosis is established the sooner proper therapy is begun. On the other hand with delay in diagnosis a tumor sometimes assumes alarming proportions. Treatment of the large tumor is almost always a problem and prognosis is poorer

HEAD AND NECK

CHEEKS NOSE AND UPPER LIP

Advanced cancers situated on the cheeks, nose or upper lip frequently act in a similar manner and have common problems (Fig 43) The histologic type of cancer occurring in these regions is usually of the basal cell



Figure 43 —Advanced, recurrent mixed squamous and basal cell carcinoma involving the nose

variety but squamous cell tumors are not infrequently seen and in the late stages the histologic picture may be mixed. As in any other area various histologic types may be encountered and the author has operated upon patients with neurogenic sarcomas and fibrosarcomas in these areas.

The progression of an upper lip cancer serves as a good example of how cancers in the adjoining areas may act (Fig. 44). True upper lip cancer is very rare. The most commonly seen cancer on the upper lip frequently arises on the skin and invades the vermilion border by contiguity. In an

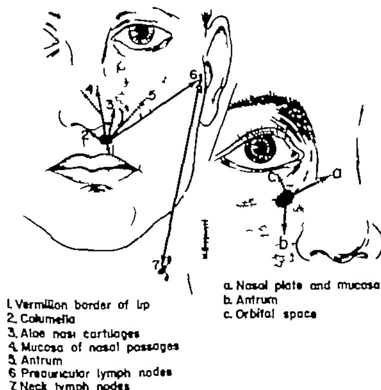
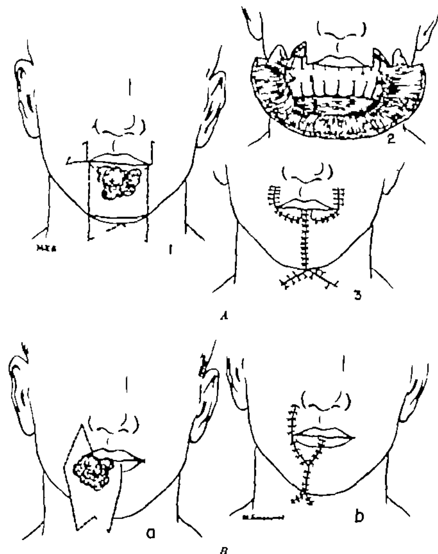


Figure 44.—Diagrams showing the direction of spread of cancers arising on the upper lip and alae nasi region, and of cancers arising on the lateral margin of the nose beneath the eyelid.

advanced stage upper lip cancer involves the columella of the nose, the alae nasi cartilages, and the mucous membranes of the external nares. Spread of the cancer backward to the posterior nasal vault, the laterally situated antral walls and to the preauricular lymph nodes on the cheek is not uncommon. Because of the close anatomy of the region, bilateral dissemination is frequent. It is these factors which give cancers in this area a poor prognosis. Even basal cell epitheliomas, which rarely metastasize, carry a guarded prognosis because of their relentless manner of recurrence and extension.

With the diffuse spread the wide area involved the numerous bony and cartilaginous structures affected roentgen therapy is used best as an adjunctive agent and one must rely chiefly on surgery as the method of therapy Operations which are performed for advanced lesions in this area are necessarily extensive and may demand resection of a portion of the nose the adjoining antral walls, and occasionally much of the cheek tissue To fail to resect the alae cartilages, or the underlying antral and nasal bones for cosmetic reasons is poor cancer surgery There should be no unreasonable cosmetic limitations to the wide resections necessary to



Figures 43A and B Surgical removal of lower lip cancer shown in diagrams ... wide and complete with excellent cosmetic repair

control these cancers. Excellent prostheses or plastic reconstruction is available to the patient who is cured of his cancer

The surgical problem in such instances is usually a local one in that cervical lymph node metastases are frequently late in occurrence or may never occur For this reason prophylactic neck dissections are not recommended but are performed as soon as node metastases are suspected

LOWER LIP CANCER.

In a clearly visible area such as the lower lip diagnosis is usually prompt and the majority of cancers treated are small Tumors 1.5 cm in size or less lend themselves to adequate therapy by many methods Despite the fact that almost all cancers of this region are histologically of the epidermoid type, they metastasize to the cervical lymph nodes late thus enhancing the prognosis of the smaller tumors.

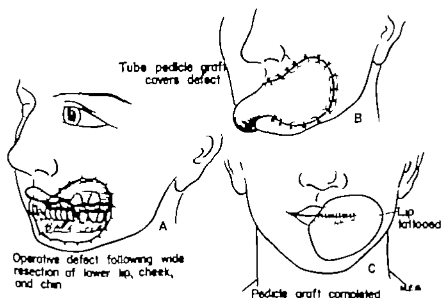


Figure 46 —Total excision of lower lip and adjoining cheek margin th tube pedicle graft repair

However when the cancer is larger cm in size and over or when it involves ne of the commissures of the mouth the problem is more complex. With increased size comes deeper muscular penetration and a tendency for more diff se l mphatic spread A ery small percentage may now even show venous asion and in the still larger tumors the problem of mandibular in asion f the periosteal l mphatics must be considered Nevertheless even the moderat l sized ancers, between 2 and 4 cm in size ma still be nsidered local problems in most instances. Such cancers require aggressi therapy which ma be either by irradiation or surgery The a thor ha a personal preference for surgery because a cancericidal

amount of radiation to tumors of this size frequently results in a depressed dry scaly lip which may need surgical correction later Wide block resection and immediate repair by one of many procedures (Figs. 45A 45B and 40) is more complete local therapy and has the added advantage of histologic study of the margins of resection Surgery is even more preferable in the younger age groups where latent radiation changes may occur ten and fifteen years later

Prophylactic dissection of the cervical lymph nodes is not recommended. However each patient must be carefully followed and at the first suspicion of an enlarged node which is usually unilateral a neck dissection is performed The author does not, as a rule perform suprahyoid dissections but recommends radical block removal of neck contents from clavicle to



Figure 4 Cancer involving the entire lower lip. Note intracutaneous metastasis in lower right corner

mandible In instances where there *may* be bilateral spread suprahyoid dissection can be simultaneously performed on each side reserving the more radical operation for the side with positive node metastases. The presence of metastases should be determined at operation by frozen section examination in order to avoid a secondary procedure Bilateral radical neck dissections have been performed on numerous occasion but usually for cancers involving the oral cavity proper or the larynx

In still larger cancers surgical therapy is extended to block removal in continuity of neck nodes, lymphatic pathways and primary tumor Recurrent cancers may be neglected by the patient so that ultimately the physician is confronted with a cancer which infiltrates most of the lower

lip the intracutaneous lymphatics running towards the neck nodes and the cervical nodes themselves (Fig 47) As a rule metastases within cervical nodes from a primary lip cancer tend to spread and grow slowly thus keeping the disease within resectable limits for a long period of time Surgical dissection of the neck nodes, therefore may be successful when done in continuity with wide resection of the lip and cheek (Fig 48) The operative defect is then repaired with a pedicle graft and excellent cosmetic results can be obtained In several instances it may be necessary to include removal of a portion of the mandible because of invasion of bone and periosteum by advanced lip cancers (Fig 49)

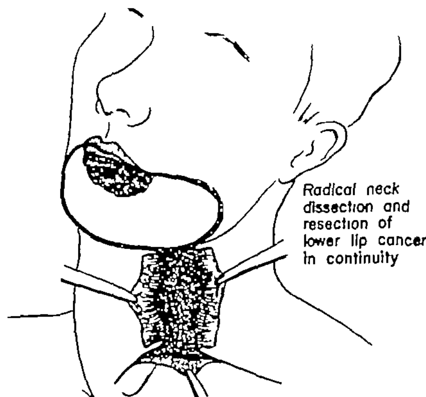


Figure 48.—En bloc dissection of neck nodes and an advanced lower lip cancer In some instances the intervening mandible must also be resected

INTRA-ORAL CANCER

ANATOMICAL CONSIDERATIONS

Cancers arising on the tongue the floor of the mouth the lower and upper gum the hard and soft palates and the buccal mucosae are loosely called "mouth cancer" This term neglects the finer distinctions of oral anatomy and disregard the differences in natural history of cancers arising on each anatomical site The key to the proper therapy of intra

oral cancer lies in the anatomy of the lymphatics of the neck. The primary cancer is often easily controlled cervical lymph node metastases are frequently a greater problem For this reason the lymphatic pathways of the neck deserve special consideration.

Situated over the carotid bulb and just beneath the tendon of the digastric muscle is the lymph node most frequently involved by metastatic intra-oral cancer Primary tumors of the tongue especially of the middle and posterior thirds of the lower gum of the lateral aspects of the floor of the mouth of the tonsil and tonsillar pillars, the buccal mucosa and extrinsic larynx frequently metastasize to this node first Recognition of this fact should call immediate attention to one of these anatomic locations.

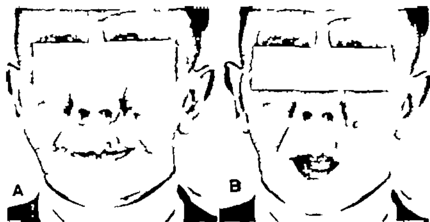


Figure 49 —Post-operative view of patient ho had an dvanced lower lip cancer i volving the mandible and neck nodes on the left. A neck dissection performed th ecrtion of the intervening mandible nd entire lower lip Reconst uction as performed ith tube pedicle gr ft elevated from the right upper best

Lymph no les which foll w the internal jugular ein are in ol ed frequently by metastases. These are divided into three broad groups superior middle and inferior and denote the anatomical level f the metastasis. A t ngue cancer for example arising on the middl r posterior third of the tongue may first metastasize to the superior group of nodes and then spread to the middle group as well In olvement f two or more groups of nodes often denotes a tumor of long duration or one whicl i very aggressive

Metastati nodes al ng the spinal accessory nerve usually signify a tumor of the nasopharynx or th maxillary or ethmoid sinuses Enlarged lymph nodes in the ul mental and sul maxillary triangles may be lue to cancers of the lower lip anterior third of the tongue floor of the mout l and anterior lower gum

Metastases t nodes are almost invariably silent Sl wly growing asymptomatic l mph nodes appearing in the neck of an adult should never be neglected and warrant further investigation

CLINICAL CONSIDERATIONS

The tumors which are of paramount interest to the dermatologist are those situated on the lower gum the upper alveolar ridge the floor of the mouth the hard palate the tongue and buccal mucosa.

Carcinoma of the Lower Gum

Frequently but not invariably occurring in edentulous people the first symptom may be an ill-fitting or wobbly denture. Its presence around jagged tooth edges, infected stumps and in areas of irritation due to badly made prostheses, is well known. Poor oral hygiene alcoholism and tobacco addiction are common accompanying features which may play some part in the etiology of this disease Patients with teeth often present a small ulcer along the gingival tooth margin which fails to heal despite oral hygiene administered for several weeks Not infrequently extractions are performed directly in the center of the ulcerated area under the mistaken impression of advanced inflammatory disease Pain is a late symptom and usually indicates superimposed infection by anaerobic streptococci so prevalent in the mouth or bone invasion.

Other cancers may start as small warty or papillary tumors. Gradual enlargement may produce ulceration or a hard firm tumor extending along the gingival surface. Increased growth causes invasion of the underlying mandible and in a short time the problem becomes one not only of soft tissue but also of diseased bone Extension to the gingivo-buccal gutter or floor of the mouth and undersurface of the tongue adds to the complexities of therapy and increases the tendency toward cervical lymph node metastases. In a short time an easily cured small tumor is changed to a ravaging menace requiring heroic measures for a cure which at times is unobtainable

Carcinoma of the Upper Alveolar Ridge

Tumors in this location are less frequent than those arising on the lower gum but have several special point of interest The close proximity of the overlying maxillary sinus may lead to involvement of an upper alveolus in cases of antral carcinoma. A common symptom of cancer of the maxillary sinus is pain about the upper molars. X-ray examination usually reveals erosion of bone at the tooth root On extraction, a socket which fails to heal because of carcinomatous invasion is often the presenting sign. Spontaneous formation of a sinus along the upper gingivo-buccal gutter is another sign of antral cancer

Cancers on the anterior portion of the upper alveolar ridge are usually warty flat plaquelike and painless They may occur in area of leukoplakia. The minority of patient are edentulous and irritation by dentures seems to play a role in the precipitation of such tumors.

Often cancers arising posteriorly are ulcerative and painful. Involvement of the musculature of the soft palat and tonsillar pillars causes pain on swallowing Pain forces the patient to seek medical advice early Therefore these tumors are small when first seen as contrasted with the anterior silent tumors. The tenet that the further posterior an oral tumor the more malignant is demonstrated by this group. A posteriorly situated

tumor involves the lymphatics more rapidly and when the primary tumor is near the midline metastases to neck nodes are often bilateral Invasion of the underlying bone occurs early and has a direct bearing on methods of treatment and prognosis. Large tumors involving the posterior portion of the upper gum are among the most difficult to treat successfully

Tumors of the hard and soft palate are directly related to alveolar ridge lesions and present the same problems. With the larger tumors it is often impossible to tell whether they arose on the ridge or on palatal tissue Extension of either tumor involves both regions.

CARCINOMA OF THE FLOOR OF THE MOUTH.

Anatomically the floor of the mouth extends from the lower gum to the undersurface of the tongue Tumors in this region are among the most malignant in the mouth Early well restricted tumors as in all other forms of intra-oral cancer can be satisfactorily managed However the larger tumor involves both the tongue and lower gum by direct extension and creates problems common to all three organs. In addition invasion of the mandible is common Usually starting as a small ulcer it spreads rapidly and metastasizes to cervical nodes quickly When present anteriorly bilateral cervical node metastases are common Pain does not occur until invasion of the mobile undersurface of the tongue or secondary infection develops. Mandibular involvement is always painful but this is a later occurrence

CARCINOMA OF THE BUCCAL MUCOSA

This is an easily accessible and readily visualized anatomic location. However despite even early diagnosis one is always guarded as to the chances of permanent cure Such tumors are invasive and infiltrative They metastasize early and when large may involve the mandible or maxilla by direct extension Small leukoplakic plaquelike elevations frequently serve as the starting point of these cancers. Ulceration and invasion occur next and as in any form of cancer increased size magnifies the difficulties of therapy This is especially true with tumors of the oral cavity where one works in a limited and anatomically restricted field

CARCINOMA OF THE TONGUE.

The tongue is a remarkable organ and i the most complex within the oral cavity Composed largely of muscle fibers it seldom rests, but constantly propels saliva and food into the esophagus. The exquisite sensation of taste is almost wholly dependent on its normal function. Its broad sweeping movements spread salivary secretions to all parts of the oral cavity keeping them moistened and protected Its functions are so vital that one is continually amazed at how long patients may neglect tumors which cripple its action.

Tumors involving the tongue are the most common oral neoplasms. The difference between an anterior and a posterior oral tumor is vividly illustrated with tongue cancers and because of this difference tongue tumors are referred to as anterior middle or posterior third lesions. Cancers

arising in each third act as tumors of entirely unrelated organs. The poor prognosis of cancer on the base of the tongue contrasts sharply with the good results of cancers arising on the anterior third.

Cancer of the tongue develops usually on the lateral borders and may begin on leukoplakic patches or as small warty excrescences, as soft, friable papillary growths, or as innocent-looking ulcers. Occasionally they are submucosal and present as firm nodules. Increase in size is progressive and symptoms, such as pain, are relatively late. Cervical node metastases, at times bilateral, occur early with tumors on the posterior third. Rich lymphatic pathways, the occult nature of tumors in this location, and the technical problems of therapy combine to dampen the ardor of the most enthusiastic therapist.

Fortunately, cancers of the posterior third represent only one-third of all tongue tumors. The remainder, arising on the tip and middle thirds, grow less rapidly and metastasize less widely. They are noticed more readily by the patient, dentist, and physician, and treatment is begun earlier in their course. In no other site within the oral cavity does early diagnosis pay such large dividends in terms of longer survival.

TREATMENT

The advanced intra-oral cancer is a surgical problem. Oral cancers have been treated with x-rays and radium for many years and results with tumors under 2 cm. in size have been *relatively* satisfactory. When the cancer is larger, however, the probability of lymphatic permeation and lymph node metastasis is greatly increased. The tumor at this stage can no longer be considered a local problem because of spread through the lymphatic pathways to the lymph nodes of the neck. It is well known that x-rays and radium, except in occasional instances, are relatively ineffective against lymphatic metastases.

Operations designed for the treatment of intra-oral cancer have as their purpose the removal in continuity of the primary tumor, the lymphatic pathways and the lymph nodes to which that tumor has or will metastasize (Fig. 50). Such a principle is exemplified by Halstead's classical radical mastectomy and Miles' abdominoperineal resection of the rectum.

In the head and neck, the mandible has represented a stumbling block to this ideal concept because of a natural reluctance on the part of all surgeons to produce mutilation. However, when a tumor is operable, rapid healing anticipated, and a good functional result obtained with adequate rehabilitation of the patient, the cosmetic factor loses significance.

The importance of removing a portion of the mandible can be realized after a brief review of the lymphatic anatomy of this region. In 1902, Polya and Navratil pointed out that in about 50 per cent of normal individuals the lymphatics of the tongue and floor of the mouth pass through the periosteum of the mandible on their way to the lymph nodes of the upper neck. On the basis of experience and the proximity of lymphatic pathways to the mandible is seen in the all too frequent recurrence of oral

cancers along the mandibular margin or of lymph node metastases fixed to the bone The concept that intra-oral cancer can be treated in a local manner is not acceptable The necessity of removing a portion of the mandible whenever cancer is close to the jaw should be emphasized

The combined operation for the treatment of head and neck cancer is diagrammatically outlined in Figure 51 In addition to this procedure there are other compromise operations which preserve the mandible



Figure 50 — *Surgical specimen of patient with cancer of the lower gum The specimen* has been purposely spread to show the continuity between gum, mandible and neck structures. (Pollack, courtesy of Ann Surg)

but include removing adjacent periosteum with the intra-oral cancer and neck contents The cosmetic result with these procedures is excellent in that there is no bone defect However they are suitable only for smaller cancers which do not involve the mandible

Results with the combined operation have been encouraging In a recent personal series 50 per cent of all patients, regardless of stage or extent of disease are alive and well two or more years following surgery

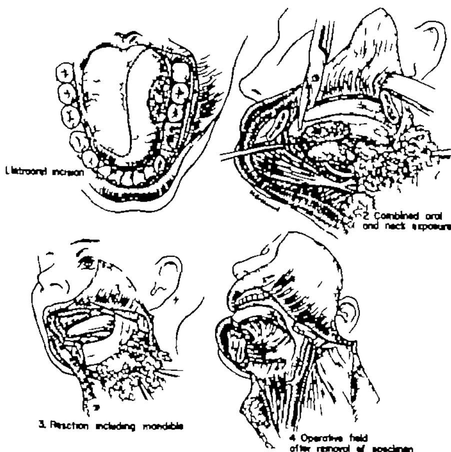


Figure 51 — Diagrams showing the extent of resection ithi the mouth and ill ε trating the continuous dissection of neck mandible and oral cancer en bloc (Reprinted through the courtesy of *A nal of Surgery* J B Lippincott C Phila Pa.)

MELANOMA

There i no doubt that some melanoma arise from junctional or compound types f nevi Once beyond this tage it is safest to consider the cancer ad anced regardless of whether the melanoma i termed superficial early or therwise Incredible a it ma seem even the small uperficial melanocarcinoma may give rise t widespread metastases. The frequency of melanoma on the soles of the feet and genitals and the infrequency of moles or nevi in thi area lead one to suspect the greater hazard of moles in these area and suggest their routine removal This practice ma be applied to any area where the mole is aggravated l local trauma Su l n excision is a minor matter and proph lactic in nature Therapy of melanoma requires wide and deep surgical removal frequentl in continuity with regional node lissections.

The puzzling observation that malignant melanoma occurs with extremely rare incidence in pre-pubertal children has created the problem of the so-called "juvenile melanoma." These are pigmented moles which bear such a close histologic resemblance to malignant melanoma that it is not possible at times, to distinguish between the two. However they do not metastasize and they may be classified as nevi and their management may be conservative. With this histologic picture occurring in a patient at or beyond puberty the surgeon is most likely dealing with a malignant tumor and is forced to proceed with a more extensive operation. True

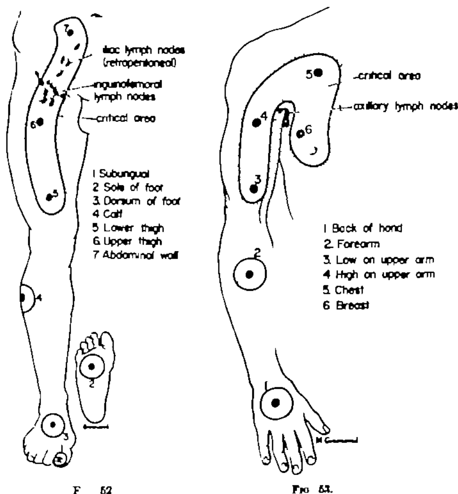


FIG. 52. FIG. 53.

Figure 52.—Melanoma situated at sites 1 through 4 are treated by wide excision and secondary groin dissection; melanoma at sites 5 through 7 by continuous dissection which includes the lymph node basin. Dotted area shows the wide undermining utilized. An ellipse of skin as outlined is usually resected as well.

Figure 53.—*Similar diagrammatic outline showing method of treatment of melanoma of the arm or upper anterior chest wall.* (Pollack. Courtesy of California Medicine.)

melanoma has been reported in some children but it is felt that the tumors in these instances differed from the benign juvenile melanoma."

Consistent with good surgical treatment of melanomas is the prevailing principle of wide and deep excision The guiding reason for these broad margins is the very high incidence of local recurrences and the notion that these recurrences are due to metastatic emboli lying dormant in the cutaneous and subcutaneous lymphatic or venous channels. Allen and Spitz feel however that the great majority of recurrences are the result of junctional foci that have been incompletely removed or have been activated subsequent to local excision. Regardless of the cause, proper treatment requires wide excision where feasible often necessitating a skin graft to cover the surgical defect. When a melanoma occurs in an area of the body close to a lymph node group such as the neck, axilla or groin it is wise to include a wide block of tissue with deep undermining and the adjacent lymph nodes in one continuous dissection. These regions are termed the critical areas, as outlined in Figures 5_ and 53 and such a resection is both reasonable and practical When however the primary tumor is on the sole of the foot or the lower forearm or the back continuous dissection is not possible and one is forced to utilize the divided procedure of wide local removal and regional node dissection of the axilla or groin. There does not appear to be any advantage in waiting two weeks between removal of the primary melanoma and the lymph node group or of removing a narrow strip of skin between primary tumor and nodes, the length of an entire extremity on the supposition that it contains the involved intervening lymphatics.

Occasionally the melanoma may be situated in the midline of the back, abdomen or neck, or midway between axilla and groin so that involvement of two node groups by metastasis is likely Should this be the case there is some doubt as to the beneficial effect of dissecting both node groups at one time in continuity with the primary tumor An alternative procedure of watchful waiting reserving surgery of the lymph nodes for the time when there is a suspicion of metastasis, would seem to be more practical. However when node metastases are already present dissection of both groups in continuity if feasible with the primary lesion is still the logical course to pursue

The value of a regional node dissection even when not performed in continuity with removal of the primary is apparent to anyone who is familiar with the occult nature of metastasis in normal appearing lymph nodes or has seen lymph nodes in the groin or axilla suddenly enlarge two and three years after the primary tumor is removed Many times such an enlargement precludes clean removal But of greater importance is the fact that regional node dissections put up a block or dam admittedly temporary against rapid widespread dissemination. After this procedure recurrences frequently appear as intra- or subcutaneous nodules proximal to the lymph node bed and can be locally removed without too much change in over-all prognosis this allows for a better outlook than if the first sign of recurrence were enlarged axillary or inguinal lymph nodes. As a rule therefore regional node dissection is worth the slight increase in surgical morbidity

Major amputations for melanomas of the extremities, although theoretically in keeping with the principles of cancer surgery have yet to prove that they cure more patients than the divided procedure of local excision and regional node dissection One must admit that with the early venous invasion of many melanomas sacro-iliac disarticulation (hemipelvectomy) and interscapulothoracic (fore-quarter) amputation appear to be very serious treatments for tumors with such a guarded prognosis.

Melanoma is not a uniformly fatal disease and one must condemn a pessimistic attitude In one recent large series, the five-year survival rate of all patients, regardless of stage was 21 per cent The five-year end results in relation to metastases in regional lymph nodes was 14 per cent for patients with positive nodes and 40 per cent for those without lymph node metastasis.

SARCOMA

Sarcomas occur most commonly in the somatic soft tissues. Early biopsy is essential and definitive treatment must await this procedure If the tumor is small total surgical excision is the most practical solution for identification With larger tumors the problem of identification is not as simple because of the hazards of incisional biopsy Uncontrolled hemorrhage in the vascular tumors or dissemination and activation of the neoplasm may result from incomplete removal of the tumor Aspiration biopsy is practiced by some and has strong advocates among a few surgeons but unfortunately not among pathologists. When an incisional biopsy is necessary the use of a frozen section examination is very helpful and practical All safeguards may be taken with the patient in surgery If the tumor is on an extremity a tourniquet can be placed above the lesion. With the report available only a few minutes after biopsy there is no delay in performing definitive treatment and dissemination may be discounted If the tumor proves to be benign or a sarcoma of low-grade malignancy a local excision or radical dissection is immediately completed If the report classifies the sarcoma as a tumor with invasive propensities and the regional anatomy is not conducive to a local radical removal an amputation may be performed proximal to the tourniquet

The majority of sarcomas of the skin and soft parts probably originate as such although instances of malignant change of benign tumors have been recorded This is not the chief reason for early removal More important is to learn the true nature of a specific tumor However occasional fibromas of fascial and subcutaneous tissues and desmoid tumors of the abdominal wall show malignant change after several unsuccessful attempts at removal. In one series the neurofibromas of von Recklinghausen disease became malignant neurilemoma in 10 per cent of the patients. Benign tumors of vascular synovial or lipomatous tissues rarely show malignant degeneration yet in each instance isolated examples have occurred

There appears to be a predilection for some sarcomas to occur in certain regions of the body For example Kaposi's idiopathic hemorrhagic sarcoma usually begins in multicentric fashion on the feet occasionally on the

hands and rarely on the penis, or oral mucosa. Liposarcomas favor the pelvic and shoulder girdles as do lipomas. Malignant synoviomas occur preponderantly on the hands and feet rhabdomyosarcomas on the upper thighs and arm Fibrosarcomas are widespread in distribution. Dermatofibrosarcoma protuberans develops in most instances on the trunk. Malignant neurilemomas occur most frequently in the forearm and leg

In treatment of a specific tumor the surgeon, in arriving at a choice between amputation and radical surgical dissection must consider many factors the histology of the tumor the degree of malignancy its mobility the anatomical location whether it is primary or recurrent the presence of regional or distant metastases and the natural history of the tumor Rhabdomyosarcomas tend to show multicentric sites of origin malignant synoviomas frequently metastasize to lymph nodes (20 per cent) fascial sarcomas recur locally in a high percentage of instances angiosarcomas metastasize to the lungs early in their course and embryonal liposarcomas are radio-sensitive These considerations suggest that the surgeon secure consent for an amputation before embarking on definitive therapy because at the time of attempted surgical dissection he may find that clean local removal is impossible and therefore precludes the possibility of a cure

When local removal of the tumor is to be performed enucleation should be avoided Most of these tumors have a pseudocapsule not a true capsule and there is great temptation for simple removal. The operation planned should be extensive with wide margins removing all of the tissues surrounding the tumor In the recurrent tumors, previous skin incisions should be widely excised with the tumor This often necessitates a skin graft for closing Bearing in mind the lethal character of sarcomas, the surgeon must remove adherent or involved nerves and arteries and be willing to accept the compromise of impaired function or disability The alternative to this is amputation.

Some sarcomas metastasize to the lymph nodes. It is, therefore wise to include lymph node dissection when the tumor lies in close relationship to the lymphatic drainage area.

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7

The Biopsy

Marcus R. Caro, M.D.

The aim in performing a biopsy of the skin is to obtain a specimen for histopathologic examination which may disclose information that will help in making a correct diagnosis. A specimen removed from an area chosen haphazardly may give no useful information and the result may be misleading.

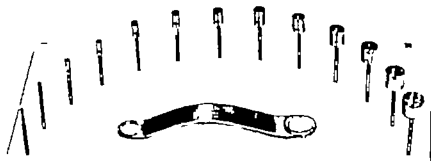


Figure 51.—Upper instruments are electric motor driven biopsy punches of various sizes. These are attached to flexible shaft motor such as that used for plating or dental drilling, and, after proper anesthesia and pre-operative antisepsis, punch biopsy is performed. This procedure has the advantages of speed, clean-cut edges and penetration of thick tissue (soles, etc.). The instrument in the foreground is a ring used to obtain hemostasis when performing punch biopsy. The ring applied with pressure collapses the superficial vessels and acts to prevent bleeding in the wound. (Courtesy Robbins Manufacturing Co., New York.)

The dermatologist has a great advantage in that he can examine all of the cutaneous lesions grossly while they are still attached to the patient. A careful search for a lesion that is characteristic of the eruption will often produce one that is suitable for histopathologic study. The gross examination of the eruption and the individual lesion should be thorough, for in many cases the distribution of the lesions and their configuration, size, color, depth and consistency may help to direct the type of histopathologic study that is indicated. An error at this stage of the biopsy may lead to the use of the wrong fixative such as alcohol which would make it impossible later to demonstrate fat in the tissue examined.

The selection of the site for the biopsy is a critical step. In his gross examination the dermatologist searches for lesions whose distribution configuration and physical characteristics will be of help in the differential diagnosis. With experience he learns to disregard those which may be confusing because of the effects of injury or previous treatment. In the same way he should select for the biopsy a lesion that is fully developed and uncomplicated for a histopathological examination may give erroneous information if it is performed on a lesion that is immature "burned-out" or damaged

In attempting to establish a suspected diagnosis one should select for the biopsy as characteristic a lesion as can be found and if possible remove it from a location involved commonly in the disease being considered If several types are noted a specimen should be obtained from each to determine if more than one dermatosis is present. It is important that each *specimen be placed in a separate bottle and completely identified as to its* site and appearance so as to preclude the possibility of later confusion.

Specimens removed from the lower extremities may be confusing unless one discounts the features commonly present because of the location The effects of stasis will often produce hemosiderous or vascular changes that may be misleading in cases of pigmentary or vascular diagnostic problems. The inguinal or femoral lymph nodes frequently show changes resulting from previous infections of the feet or legs and these features may be misleading when one is attempting to establish the diagnosis of lymphoma

It is the practice of many pathologists to prefer specimens that are taken within the lesion, so that only pathologic tissue is submitted There is however an advantage to removing the biopsy specimen from the border of the lesion so that a small area of normal tissue is included The presence of normal tissue at the side of the section makes it possible to study the advancing border of the lesion and this is useful especially in tumors and chronic granulomas. Before such a specimen is removed from the skin however it should be bisected with a superficial incision or an indelible linear mark that will cross both the lesion and the normal area. This directional marking will enable the technician to extend the cut and t bisect the specimen correctly so that each section will contain both the pathologic and the normal areas. Failure to mark such a specimen ma lead to the obliteration of the outline of the lesion during fixation and ma result in the faulty bisection of the specimen into a normal half and a pathologic half with a possible processing and futile sectioning of the normal half

The skin at the site selected should be cleansed with soap and water and sterilized by the application of alcohol or zephiran solution. Local anesthesia may be produced by injecting a 1 per cent solution of procaine hydrochloride For very small lesions or pedunculated ones the injection of a local anesthetic may not be necessary for sharp instruments and a rapid technique may make the procedure relatively painless.

While many lesions are superficial and require merely a superficial specimen for diagnosis, in others the pathologic changes lie deeply in the corium or even in the hypoderm. A deep specimen is necessary to demonstrate the characteristic changes in such cases. The type and depth of the

lesion will determine not only the depth of the specimen needed but also the type of surgical procedure that is indicated in performing the biopsy.

For most lesions the preferable method for obtaining a specimen is cold steel surgical removal. A specimen removed in this way may be readily sectioned in the correct plane and it should take stains well.

In suspected basal cell epithelioma or a seborrheic keratosis a small sharp curette will obtain sufficient material for diagnosis. By the use of the curette one may often continue to remove the entire lesion in these cases and combine the biopsy procedure with definitive treatment. After curettage the base may be treated by electrocautery or by fulguration. Pedunculated lesions may be clipped off with scissors, but one should always include the base of the lesion in the specimen to be examined. In most instances the base may be treated with electrocautery to leave a good cosmetic result.

For large and deep biopsies an elliptical excision with a scalpel should be performed and the wound should be closed with sutures. When such an excision is made on the face it is important that the long axis lie in one of the wrinkle lines so as to minimize the appearance of the resulting scar. The sutures should be removed as soon as they are no longer needed and the sides of the wound should be kept from separating by applying a splint of adhesive plaster that is placed perpendicularly to the line of incision.

Smaller specimens may be removed by the use of a cutaneous punch. This is drilled through the skin to the desired depth and the separated specimen is then lifted away from its site and cut off at the base with a scalpel or scissors. The cutaneous punches used most often vary in diameter from 3 to 6 mm. The resultant wound seldom needs suturing. A small disc of Gelfoam cut to fit the size of the defect is applied and the wound is covered with a dry dressing.

Biopsies performed by the utilization of electrosurgery are not always satisfactory. There is always the risk of burning the specimen and ruining it for study. Even when the damage is not complete the tissues may show changes that result in distortion of the cells and fibers and in a confusing alteration of the staining reactions. The use of the power-driven biopsy punch has the advantage of great speed, which makes it relatively less painful than the manual procedure. This is offset to some extent, however, by the degree of heat produced in the rapid rotation, which may also at times produce some alteration in the staining reactions of the specimen obtained by this method.

In all procedures the specimen should never be removed from the skin with forceps or any other instrument that may squeeze it or in any way distort its original relationships. It may be lifted up with a needle, the curette or the scalpel and, if large enough to be curled, it should be flattened on a card before being dropped into the fixative solution. A specimen that is squeezed and twisted before fixation can produce only sections that are so distorted that no useful information can be elicited from their study.

For routine sections the fixative used most often is 10 per cent formalin (4 per cent solution of formaldehyde). Specimens fixed in this are suitable for frozen sections to be examined for fat as well as for further processing through paraffin. When the presence of mucin is suspected absolute

alcohol should be used as a fixative, for other fixatives will result in stains that fade rapidly.

It is important that each specimen be placed in a separate bottle and identified by a label that cannot be separated and lost. Much time is wasted attempting to identify specimens in the laboratory and occasionally mistaken histopathologic diagnoses are reported because specimens may be mixed. It is also important that the specimen be accompanied by all the pertinent information about the case, such as the age, sex and color of the patient and the site of the biopsy. This information will give the pathologist a base line for comparison with what should be the normal findings. A description of the eruption, a gross description of the lesion that is being submitted and a listing of all the diseases being considered in the clinical differential diagnosis will be of additional help to the pathologist. In difficult cases, such clinical information may aid him in deciding whether the section is diagnostic of, suggestive of, or possibly incompatible with any of the diseases under consideration.

The biopsy is a cooperative procedure directed toward the establishment of a correct diagnosis. For best results it requires the closest collaboration of both clinician and pathologist in the selection and removal of the specimen, the disclosure of histopathologic features and the joint interpretation of the findings. It deserves all the meticulous care and thoroughness that are accorded to a necropsy, for it is even more important to reach a correct diagnosis in the living patient than to establish it post mortem.

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PART II ELECTROSURGERY

8

Endothermy and Electrocoagulation

Samuel Ayres, Jr., M.D., and Samuel Ayres, III, M.D.

THE term "endothermy" translated literally means internal heat and refers to the development of increased temperatures within the body tissues as the result of the passage of a high-frequency electric current through the body. The location and size of the heated area are determined by the location and size of the electrodes which are applied to the body. If both

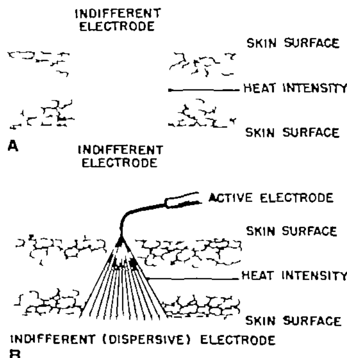
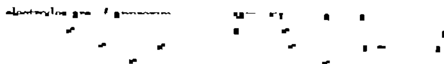


Figure 85.—Principles of high-frequency electrical current. *A*, Electrodes large, equal in size and opposite—heat develops evenly between electrodes (medical diathermy). *B*, One electrode large (indifferent), one a needle point (active). Intensity of heat develops in a small zone at the point of contact with the needle point, producing destruction of tissue (surgical diathermy = electrosurgery or endothermy).



(active or operating electrode) the area of heated tissue will be small the heat will be intense and will be concentrated close to the surface at the point of contact of the small electrode. If the active electrode consists of a pointed instrument the heat will be intensified at the surface and also below the surface when a needle-tipped electrode is allowed to remain in contact with the skin or is inserted into the skin (Fig 55B)

The induction of mild heat throughout the tissues between electrodes of equal size is referred to as medical diathermy whereas the development of high temperatures causing local tissue destruction near the surface is spoken of as surgical diathermy

PHYSICS OF ELECTROSURGERY

Electrosurgery (surgical diathermy or endothermy) depends upon the generation of heat within the tissues due to their resistance to the passage of a high-frequency electrical current that is an alternating current which changes its direction of flow at a high rate of speed (up to several million cycles per second)

This is to be distinguished from electrocautery (an electrically heated wire) which is simply externally applied heat, and from electrolysis, which is the use of a galvanic (direct) current to produce chemical cauterization of tissue due to the formation of sodium hydroxide in the tissues with liberation of hydrogen at the negative pole or hydrochloric acid with liberation of oxygen at the positive pole.

Electrosurgery may be divided into three major headings (1) electrodesiccation (fulguration) (2) electrocoagulation and (3) electrosection (cutting) High-frequency alternating current is employed in each instance By the usual definition electrodesiccation is monoterminal while electrocoagulation and electrosection are biterminal that is, there is an active or operating electrode and a dispersive or indifferent electrode

Electrodesiccation (the present tendency is to use fulguration synonymously without trying to distinguish between the two based on whether the electrode is in contact or at a slight distance from the tissue) is produced by a current of comparatively high voltage and low amperage using a monoterminal electrode The oscillations are damped that is, the intensity of the voltage rapidly diminishes with each oscillation followed by a gap when there is no current the cycle then being repeated (Fig 56A)

Electrocoagulation is produced by a current of high amperage and relatively low voltage using biterminal electrodes. It, too is characterized by damped oscillations (Fig 56A) Both electrodesiccation and electrocoagulation are produced by a spark-gap apparatus.

Electrosection (cutting) which also uses biterminal electrodes is produced by a current which is undamped in the case of a vacuum tube apparatus and moderately damped with a spark-gap apparatus. That is to say an undamped current has a regular pattern of oscillations with a constant voltage

peak in each direction (Fig 56B) A moderately damped current combines features of both so that the voltage peak does diminish progressively until the next "wave train begins, but the latter are closely spaced so that there is no gap between them as in undamped current (Fig 56C) The significance of this in terms of its effect on tissue will be discussed shortly

Electrodesiccation implies that the tissue is merely dried out due to the water being evaporated from the cells, whereas with electrocoagulation there is a greater destruction due to complete coagulation or cooking of the tissue fluids from more intense heat.

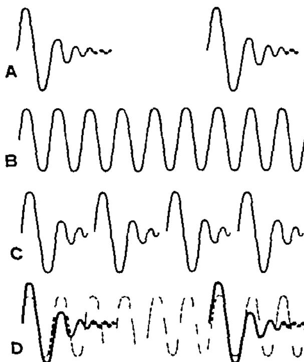


Figure 56 Diagrams of ve patterns of high-frequency current A Highl damped. B Undamped. C Moderatel damped. D Blended damped and undamped.

In common parlance the term electrodesiccation is used to indicate the use of a monoterminal current previously stated but I increasing the intensit of thi current greater destruction amounting to coagulation and harring can be achieved Similarly electrocoagulation i used to designate biterminal destruction et by increasing the resistance in the circuit the amperage can be reduced with a corresponding reduction in the destructive effect a is done for example when the biterminal current is used for epilation Thu in practice there is a degree of overlapping in terminology when relating the t pe of current used to the actual effect on the tissues

The cutting current produces actual dissolution of the tissue comparal le t a scalpel. The exact mechanism by which this is produced is not under

For the protection of the patient and the physician alike a biopsy is always indicated in case of an obviously malignant lesion, a lesion suspected of being malignant, or a lesion of undetermined nature. The authors have observed a number of instances of malignant melanomas which masqueraded as pyogenic granulomas, of benign acquired hemangiomas containing old blood which simulated melanomas and of chancres and gummas which had been, or were about to be treated as epitheliomas. A small punch biopsy followed by electrodesiccation or a specimen removed by the cutting current by means of a small wire loop will not endanger the patient provided the report is obtainable within approximately a week.

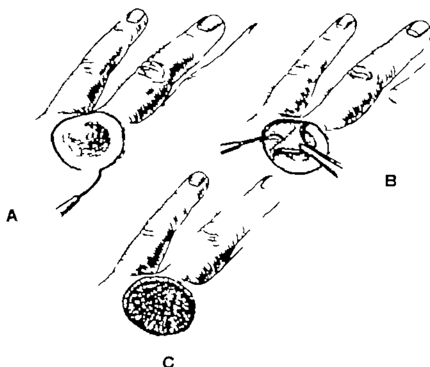


Figure 57.—Steps in removal of squamous cell epithelioma (carcinoma) from the back of the hand with the cutting current. *A*. Area to be excised has been circled with light electrodesiccating current, then the excision proceeds. *B*. The excision is being completed with the aid of rat-toothed forceps. *C*. Lesion has been excised. Base and sides have been electrodesiccated.

Under selected circumstances, at the discretion of a competent dermatologist and in the presence of a rapidly growing lesion, the preliminary biopsy may be dispensed with, the entire excised specimen serving as a biopsy. In all cases the entire specimen of removed tissue should be examined microscopically to determine the adequacy of the operation, and if any strands of malignant cells are found extending to the bottom or the sides of the block, further operative procedure is indicated.

Procedure.—The operative field is cleaned with alcohol and a suitable local anesthetic such as 2 per cent procaine containing epinephrine 1–40 000 is infiltrated through three or four punctures in such a manner as to surround completely the lesion with a broad band of anesthetized tissue The inclusion of the epinephrine is important for three reasons to prolong the anesthetic effect by vasoconstriction, to minimize bleeding and to visualize the operative field by the blanching effect. It is inadvisable to allow the needle to penetrate the malignant tissue The anesthesia is complete within a matter of minutes.

As a preliminary step it is useful to outline the proposed area of excision by means of a light electrodesiccating current (Fig 57) This serves the double purpose of marking out a pattern of the operation and at the same time testing the efficacy of the anesthesia. If this procedure elicits pain

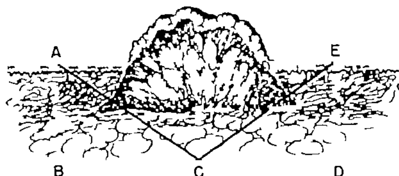


Figure 56.—Schematic drawing after an actual microscopic section of a squamous cell carcinoma. The sides of the excised tissue should be at right angles to the surface and the base should be parallel to the surface thus removing a cylinder-shaped block, *ABDE*. A wedge-shaped block, *ACE* might leave behind lateral extensions of the lesion.

additional procaine can be injected where needed An ample margin of normal skin should be included in the area to be removed on the chance that there might be subsurface lateral extensions of the malignant tissue The diameter of the total area to be removed should be at least 1½ times the diameter of the original lesion, and in the case of melanomas should include an area to 3 times the width of the lesion

The indifferent electrode may be either in the form of a metal plate placed under the patient back with his palm lying flat on it or in the form of a broad metal handle which the patient grasps firmly The active electrode is usually a needle point which is either straight bent or curved or a narrow blade according to preference The machine is set for the cutting current

With short swift strokes, the needle is applied to the mark previously outlined using relatively light pressure The skin separates along the needle path being very lightly seared at the same time Gradually the lesion is encircled and the cut carried straight downward in a plane at right angles to the skin until the desired depth is attained The loosened block

of tissue is then held with a pair of rat tooth forceps lifted up on one side and the separation of the tissue is completed by dissecting away from the underlying tissues on a plane parallel with the surface. Thus a cylinder shaped block of tissue is removed. A V-shaped block may leave behind some lateral extensions of the lesion (Fig. 58). The depth of the cut is determined by the tissue involved. In the case of lip lesions, the cut is carried down to the first visible signs of muscle tissue provided there is no gross evidence of the lesion at that level. In the case of growths on the general cutaneous surface the cut is carried down to the deep connective tissue. Lesions on the dorsum of the hand seldom extend below the fascial plane and such lesions, by careful dissection can usually be stripped off the fascial layer through the loose areolar tissue without perforating the tendon sheaths. It is extremely important not to break through the tendon sheaths.

Unlike a cut made by a scalpel there is virtually no bleeding when the cut is made by the cutting current because of the light searing effect. If a larger vessel is cut, the dial setting on the machine can be momentarily changed from cutting to coagulating and the bleeding points briefly coagulated. If this is inadequate to halt the bleeding the severed vessel can be clamped with a small hemostat and the coagulating current applied to the clamped area. After the specimen has been completely removed the base and sides of the cavity can be electrodesiccated by means of the unipolar current to minimize post-operative oozing.

Immediately following the operation there is a tendency for the severed edges of tissue to pull outward due to the natural traction of the elastic fibers, so that the circumference of the wound appears somewhat larger than the area originally marked for excision. There is no cause for alarm but it should be explained to the patient in advance. Some operators employ sutures or skin grafts to close the wound but it has been our preference to allow the wound to granulate in and in our experience the resultant scar has been relatively inconspicuous frequently assuming a linear form. While skin grafts may be necessary to fill large defects they are rarely if ever necessary in cases likely to be encountered in dermatologic practice. Grafted skin never matches the surrounding skin and always looks like a patch or a piece of inlaid wood having a different color and texture.

It is important to follow the post-operative course closely in order to obtain the quickest healing with the least amount of scarring. An antibiotic ointment such as a combination of bacitracin and neomycin or scarlet red ointment for the first week or two prevents secondary infection and allows the healing process to begin. As the granulation comes in from the sides and the base it is permissible gradually to allow the wound to form a crust either spontaneously by using dry dressings or by the application of blood powder such as Ivocyte. If there is the slightest tendency for the granulation to become exuberant they should be painted at frequent intervals with 10 per cent silver nitrate. The prolonged use of ointments favors the development of exuberant granulation tissue and the latter predisposes to hypertrophic scars.

If a thickened scar appears imminent or has actually formed superficial x-ray therapy should be started at once employing a dose of approximately 150 r units with 1 mm aluminum filter once every two weeks for three or four doses, or more if needed

When cutaneous surgery with the cutting current is properly carried out and the post-operative period is adequately supervised, the resultant scar is usually inconspicuous.

In dealing with any cutaneous malignancy the possibility of metastasis to regional lymph nodes must be considered In the absence of palpable nodes, there is no indication for carrying out lymph node dissection except in the case of melanomas. If any regional nodes are palpated a lymph node biopsy should be done.

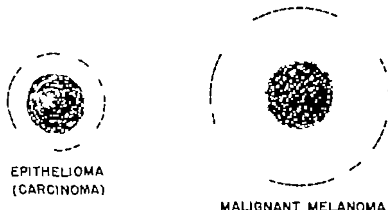


Figure 50.—Approximate minimal amount of normal skin which should be removed with the cutting current in epithelioma (carcinomas) as compared with malignant melanomas. A post-operative biopsy will determine if all of the local lesion has been excised.

MELANOMAS AND OTHER PIGMENTED LESIONS.

The procedure for the removal of a melanoma by the cutting current is similar to that described under epithelioma. However a melanoma is a more serious problem It is likely to have metastasized either through the blood stream or the lymphatics by the time it has attracted enough attention for the patient to seek treatment Having established a diagnosis of malignant melanoma the local lesion must be excised by a wide margin—considerably wider than in the case of an epithelioma (Fig 50) The best thinking among qualified experts at the present time favors extensive dissection of the lymphatic drainage of the involved area even in the absence of palpable nodes.

On the other hand radical surgery should not be carried out on every darkly pigmented lesion unless biopsy proves it to be a malignant melanoma. An acquired hemangioma containing old blood may simulate a melanoma both in color and form A pigmented basal cell epithelioma should be destroyed but does not call for the type of radical procedure used in melanomas. Darkly pigmented dermic nevi or fleshy moles, pigmented

seborrheic keratoses and the blue nevus of Jadassohn are all benign in nature and can be treated conservatively with an eye to the best cosmetic result. A biopsy should always be employed when in doubt.

The so-called junction nevus, the flat black or dark brown macule, may be the precursor of the malignant melanoma, especially if subjected to repeated trauma. Increase in size, in depth of pigment or evidence of inflammation is an indication for removal by ample excision either with the cutting current or scalpel surgery.

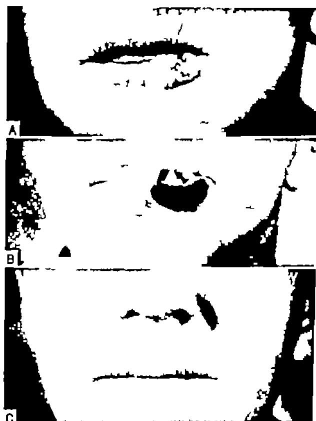


Figure 60.—*A*. Squamous cell epithelioma of lip. *B*. Immediately following removal of lesion by cutting current. *C*. Inconspicuous scar after healing of wound. Surgery was done seven years ago. Patient has recently reported that his lip remains well and causes no trouble.

Basal Cell Carcinoma

Many dermatologists prefer to treat basal cell epitheliomas by radiation from x-ray or radium or by a combination of electrodesiccation and curettage. The principal indications for the use of the cutting current in the destruction of basal cell epitheliomas are those cases in which the growth has extended deeply to involve underlying structures, such as



Figure 61.—*A*. Extensive squamous cell epithelioma of lip. *B*. Inconspicuous scar following removal by cutting current. No grafting or suturing.



Figure 62.—Nevus araneus or spider nevus. A type of lesion suitable for treatment by means of electrocoagulation using very mild current.



Figure 63.—Granuloma pyogenicum on the front of neck. A type of lesion suitable for destruction by means of electrocoagulation provided the possibility of melanoma has been ruled out.

periosteum perichondrium or deep connective tissue and especially where the lesion has recurred in a scar following previous treatment by either surgery or radiation. Lesions which involve periosteum or perichondrium or in which strands of epitheliomatous cells infiltrate between layers of connective or adipose tissue are notoriously resistant to radiation. In such cases it is preferable to remove the entire involved area by means of the cutting current, dissecting off the involved periosteum or perichondrium if necessary and allowing fresh normal tissue to granulate in.

CUTANEOUS HORN

The cutaneous horn is in reality an overgrown senile keratosis. Small lesions are usually benign and may be destroyed easily and with good cosmetic results by electrodesiccation and curettage Larger lesions however especially with an enlarged and inflammatory base may be undergoing transformation into squamous cell epitheliomas and should be excised by the cutting current

SENILE AND SEBORRHEIC KERATOSES.

These are benign lesions although the senile or actinic type may undergo subsequent malignant change. They are best treated conservatively by electrodesiccation and curettage freezing with solid carbon dioxide or other superficially acting agents. Only those lesions which are hypertrophic inflammatory or exhibit features suggestive of malignant degeneration qualify for the cutting current, and in these the loop electrode may be used

KERATO-ACANTHOMA

Recently these tumors have been segregated into a category of benign neoplasms usually occurring on exposed areas, developing rapidly up to a certain size then sometimes persisting or disappearing spontaneously These lesions are believed by some to account for various reports of self healing epitheliomas. Clinically and even histologically the lesions strongly resemble squamous cell epitheliomas. In the interest of safety and of not neglecting a bona fide squamous cell epithelioma it is desirable to remove such lesion with the cutting current in the same manner as indicated for the treatment of squamous cell epitheliomas

KELOIDS AND HYPERTROPHIC SCARS.

The cutting current may be employed to facilitate the treatment of markedly thickened or old keloids and hypertrophic scars Keloid are prone to recur after ordinary surgical excision Small and recent lesion may be treated successfully by a series of superficial roentgen treatment using a dose of 150 r filtered through 1 mm aluminum at two-week interval for 10 or 12 doses. Old and markedly thickened lesions may be resistant to radiation However the surplus tissue may be removed by the cutting current using a blade-type of active electrode and shaving the lesion to a level flush with the surface of the skin The surface of the wound should then be painted with 10 per cent silver nitrate and kept dry Following this a series of x-ray treatment as described above may be administered A number of vigorous freezings with solid carbon dioxide or a thick slush

of carbon dioxide "snow" and acetone may be used for the same purpose. Hydrocortisone or one of the newer cortisone derivatives applied in a non-greasy base may exert some inhibiting effect on the reformation of excessive scar tissues.

Dermic Nevi or "Common Moles," Soft Fibromas and Cutaneous Tags.

These lesions could be removed with the cutting current. However inasmuch as they are benign and a good cosmetic result is the primary objective, usually a better result can be achieved by means of light electrodesiccation followed by shaving the growth flush with the surface of the surrounding skin.

Ulcers.

The sluggish purplish undermined ulcer (Meleney type) caused by micro-aerophilic streptococci or a mixed infection sometimes can be brought under prompt control by removing the entire area widely and deeply by means of the cutting current as in the case of an epithelioma. The wound then should be sterilized with alcohol and 2 per cent gentian violet and blood powder (Lyocyte) dusted on once daily allowing an external clot to form.

In conclusion, it may be said that electrosurgery plays an important role in the practice of dermatology. The unipolar electrodesiccating current is discussed elsewhere (Chapter 10, p. 157).

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9

Cautery Excision

Ervin Epstein M D

CAUTERIZATION refers to the destruction or removal of tissue by heat or chemicals. Surgical cauterization concerns the former only and this discussion covers this phase of the subject. This destruction may be accomplished by a number of instruments shaped as a loop a blade a needle or a number of other objects. For all practical purposes the cautery has proven of greatest value in the excision of malignant tumors. Other indications include certain precancerous dermatoses (such as leukoplakia and erythroplasia of Queyrat) and rare localized granulomas including deep fungus infections tuberculosis etc Other methods have proven more valuable or desirable *in most infections disseminated granulomas and benign neoplasms.* Only the blade or loop type of cautery that can be employed for excising such lesions will be considered here

The use of the hot cautery originated in antiquity Nothing is to be gained by reviewing the history of the development of this modality Its popularity has waxed and waned during the past half century However a reasonable evaluation of its worth in comparison with other surgical measures can be given now It is felt that this approach has much to offer in the eradication of visible malignant neoplasms.

DESCRIPTION OF APPARATUS.

There are many brands and types of cauteries. The most useful ones are those with a silver or platinum scalpel-like blade The blade may vary in size and configuration. It may be straight or curved Other cutting cauteries are in the shape of a loop

These instruments plug into a wall socket supplying 110 volts in an alternating current A rheostat is included in some models for control of the intensity of the current The heat is produced by a resistor placed somewhere in the setup The simpler instruments consist only of a cord a handle and a cutting blade The resistor is in the handle in such cases Some have a light in the handle supposedly to illuminate the operative field However the operator should use a separate surgical light or other powerful light source The light in the handle is small and serves no purpose other than to indicate that the cautery is on. Some instruments have a manually operated off-and-on switch or a foot control One is turned on or off by slipping a sleeve up or down on the handle

ADVANTAGES OF CAUTERY SURGERY

With refinements in surgery in general the use of the hot cautery has declined in popularity The question might be asked Why should this

form of surgery be continued? What advantages, if any, are inherent in this approach? When we examine this method, we find a number of important features suggesting that it will not become extinct.

Cautery surgery is simple. It does not require extensive training to perform. Naturally the experienced operator does better work, but even the novice can obtain respectable results. It does not necessitate an extensive setup. The equipment is inexpensive. Sterility is not a prime requisite as it is in cold steel surgery.

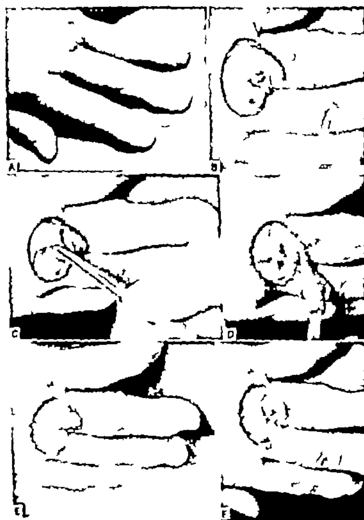


Figure 61. Technique of cautery excision. A, Coccidioidal granuloma recurring in scar five years after cautery excision. B, Incision through skin. C, Lifting diseased area for undercutting. D, Undercutting nearly completed. E, Involved area removed; some bleeding. F, Hemostasis obtained by touching bleeding area with cautery.

Hemostasis is adequate and usually complete There is little need to catch and tie bleeders. Most bleeding points can be eliminated by touching with the hot blade The blood in large blood vessels tends to cool the cautery so these structures are seldom opened although this complication can occur with disastrous results. However with experience and care one can dissect cancer tissue off major blood vessels. Bleeding seldom obscures the operative field

While the cosmetic results may leave something to be desired in some cases, they compare favorably with other electrosurgical approaches. They are better than that obtained by electrodesiccation and curettage if the latter is done as extensively as a cautery excision. The tendency of these scars to contract and form linear ones plus the excellent regeneration in lip lesions, usually results in a satisfactory post-operative appearance The tendency for surgical scars to improve and radiation sequelæ to become more marked with time means that the eventual cosmetic result is superior in many instances to that obtained with cancericidal doses of radiation.

In the removal of cancers of the skin the operator has the advantage of a built-in safety factor Most cutaneous malignancies recur because the operator has not sacrificed sufficient normal-appearing tissue After the surgeon has completed his cautery excision several millimeters of tissue sloughs out from the edges and bottom of the wound Therefore the cautery may compensate to some extent for the physician's timidity or concern for the post-operative appearance of the patient

One can be very radical in doing a cautery excision since there is no need to close the wound—in fact it should never be done Healing is accomplished by the development of granulation tissue at the base of the wound and the growth of epithelium from the sides. Skin grafting is unnecessary but grafts may be applied to the granulation tissue if desired.

The cautery cut much more slowly than the scalpel or endothermy knife However the elimination of many steps such as the clamping and tying of blood vessels the need for undercutting the adjacent skin, the closure and or skin grafting makes cautery excision a rapid method of removing cutaneous tumors.

DISADVANTAGES.

The main disadvantage is the slow healing An average epithelioma requires four to five weeks to heal after this procedure This may stretch into months if the excision is extensive Healing on the breasts scalp and legs is particularly sluggish However the rate of healing can be accelerated b the use of elastic adhesive dressings or by skin grafting

The cosmetic results are erratic As stated above the scars are often excellent but in some instances they become hypertrophic and contractile producing an unsatisfactory appearance

TECHNIQUE

Pre-operat re Preparation —As a rule little pre-operative preparation is necessary Apprehensive patient may be given sedation. Barbitals are adequate Most neoplasm can be removed in the office Draping is not

essential. In fact if it is used the drapes should be placed at a sufficient distance from the operative field to avoid the dangers inherent in the inflammable nature of cloth

Anesthesia —This is not an important phase of the surgical technique Percy claimed that the cautery bearing his name gets so hot that no pain can be felt While I have seen him do very extensive surgery without anesthesia, this requires a stoical patient. Local infiltration with procaine or other local anesthetics is advisable This should be injected intradermally along the line of excision as well as subcutaneously The patient should be warned that this will prevent pain but will not eradicate the sensation of heat. The latter is due probably to the radiation of heat from the instrument to the surrounding skin which is not anesthetized

General anesthesia can be used if desired Intravenous anesthetics are preferable because of the general advantages of such agents in surgery plus the elimination of the danger of a hot cautery in the presence of inflammable inhalant gases.

Operation.—The actual operative technique does not differ whether the blade or the loop cautery is used. Antisepsis of the skin is unnecessary since the heat of the instrument makes it self-sterilizing If local anesthesia is desired alcohol may be used for pre-injection sterilization or any other agent may be employed for this purpose as preferred by the operator One can judge when the instrument is hot enough to use When the cautery will cut through absorbent cotton without pressure it is ready for use on the normal skin.

In excising a lesion such as an epithelioma, an incision is made in the skin with the cutting tip. This should surround the tumor completely It should be sufficiently deep to get under the lesion and wide enough to include all of the neoplasm plus sufficient normal tissue to insure the removal of all microscopic prolongations of the growth. While all prolongations of the tumor can not be identified in all cases (chapter on Chemosurgery p 171) in most instances, the excision of an area of normal skin extending ¼ to ½ an inch (0.5 to 1.0 cm.) beyond the visible margin of the tumor will prove adequate This must be dictated by the surgeon's judgment and experience

Next one corner of the tumor is lifted with a toothed forceps. Starting at this corner the cautery is used to cut under the new growth until it is completely freed from the remaining tissue As a rule the specimen should be placed in a bottle of 10 per cent formalin and sent to the laboratory for microscopic examination. The extent of the tumor can be judged by cutting the excised specimen and examining it grossly Epitheliomas are whiter and firmer than the surrounding tissue while melanomas are blacker While this inspection is less accurate than the microscopic control of chemosurgery it does offer a gross method of judging the adequateness of the removal. This can be checked later by examination of the histologic section.

Hemostasis can be obtained in most instances by merely touching each bleeding point with the cautery If the vessels are too large to yield to this maneuver the bleeding may be stopped by a hemostat and hemorrhage controlled by tying or suturing and tying

A gauze dressing with just enough boric acid ointment on it to prevent sticking is placed over the wound. As little adhesive tape as possible is employed.

Post-operative Care.—The patient should be warned immediately after the operation of two possible complications. The first is bleeding. If this occurs, the patient should remove the dressing and apply pressure to the wound for ten minutes. If this fails to accomplish the desired result, or if the bleeding is profuse, the surgeon should be called as it may be necessary to tie off a bleeder. The second point is that in two to four days, the wound will start to discharge a purulent looking material. This is not pus. It is the burned margins of the wound sloughing out. This is not an indication for antibiotic or antiseptic therapy. It occurs in nearly every case and is physiologic. However, a physician who is unacquainted with such wounds will be concerned about this development. It persists for about two weeks and is followed by the healing of the incision. Post-operative infection is very rare. The wound is sterilized by the heat of the instrument. The cauterization of the tissue seals the wound preventing the entrance of micro-organisms. This, coupled with the natural resistance of the cutaneous surface, makes infection a rarity in such wounds. Post-operative pain is unusual.

The first dressing should be changed in about three days and then daily. This is made necessary by the drainage. However, it is a simple matter to teach the patient to do his own dressings. As a rule, the patient returns for observation twice a week. Enough boric acid ointment is applied to the dressing to prevent the latter from adhering to the wound.

It is wise to use as little adhesive tape as possible on the dressings in order to allow the drainage to escape as well as to minimize tape dermatitis. Since the patient will require a dressing on the treated area from four to six weeks in most instances, it is wise to alternate the direction and position of the tape to decrease tape irritation of the skin. Cellophane tape has not proved superior to adhesive tape in preventing cutaneous irritation in these cases.

Grafting may be done when the sloughing is completed and clean healthy granulation tissue fills the wound. However, this is unnecessary.

Healing is accomplished by the formation of granulation tissue in the depths of the wound. At the same time, the defect becomes covered with epithelium growing in concentrically from all sides. If the relationship of the rate of growth of the granulation tissue and the skin is controlled properly, the scar will be comparatively smooth.

When the granulation tissue rises above the margin of the wound, it is wise to treat it with a solid silver nitrate stick. The granulations should be maintained at or below the level of the normal skin. When healing is complete, boric acid ointment can be applied occasionally to remove scaling or crusting that may occur on the scar.

The scar may remain smooth or become hypertrophic. In the latter instance it is elevated above the level of the surrounding skin. In either case, the scar tends to contract and form a straight line. It is surprising how a large circular cicatrix will alter its shape with time to form a linear scar. While this is often wider, in general the scar then resembles one

resulting from a surgical excision and suturing While this transformation in the configuration of the scar occurs commonly it does not always do this. Unfortunately there is no way to predict in which cases this will occur or what steps can be taken to produce this linear effect following the cautery production of a circular oval or irregular defect

On the lip regeneration following extensive cautery excision is rapid and complete Scarring and deformity is at a minimum following this procedure On the other hand healing is slow and scarring often excessive on the legs scalp and female breasts. Healing may be accelerated in some instances by the use of an elastic adhesive dressing (such as elastoplast) applied with pressure and changed no more often than once a week.

Results.

Therapeutic accomplishments obtained with any modality necessarily varies with the skill of the operator and the selection of cases. Therefore published series offer no proof of the superiority of one approach over another in the treatment of cancer Even comparisons of series treated by different methods by the same operator do not establish superiority or inferiority of a form of treatment because the individual's skill and training is not equal with each method that he may employ

Remembering the old adage that "there never was a skin cancer that could not have been cured at one time with a hot nail, one must realize that the use of an actual cautery for excision of a cutaneous malignancy is effective In the hands of an expert it is one of the most potent tools in the fight against cancer in the individual

The ordinary small basal cell or squamous cell epitheliomas encountered in dermatologic practice can be removed easily and completely by this method Large neoplasms of these types can be excised if they are confined to the skin accessible mucous membranes (such as the lips) and subcutaneous tissue If the lesions invade the orbit bones or lymph nodes other methods should be employed However if desired the primary tumor may be removed by cautery excision prior to lymph node dissection or enucleation of the eyeball Only the most advanced epitheliomas of the skin and lips are not amenable to this treatment In the hands of an experienced operator simple cautery excision offers an excellent prognosis in these neoplasms.

The basic outlook in melanomas and sarcomas is different. Because of early metastases any local therapy may prove to be of temporary benefit only The rapid extensive local spread of sarcomas poses another technical problem. However the removal of these tumors can be accomplished by cautery as well as with any other modality It allows for the removal of large areas of surrounding normal skin One does not have to consider such technical problems as closure that often act as a deterrent to adequate removal. In a study of 28 patients with sarcoma involving the skin this approach proved as effective as more radical measures, such as amputation with much less disability Since these tumors occur often in younger age groups, disability becomes an important consideration.

Precancerous lesions may be removed with a cutting cautery also In some instances the lesions are superficial and more easily destroyed by

less destructive approaches This is true particularly of senile and seborrheic keratoses However it is very valuable in leukoplakia, erythroplasia of Queyrat and other extensive deeper processes.

Malignancy of the skin constitutes the prime indication for cautery excision. Better cosmetic results can be obtained in most benign neoplasms by other approaches However if such a lesion is extensive and poses great technical difficulties in its excision or destruction, removal with a cutting cautery might well be the treatment of choice It should be remembered that the cosmetic results following cautery removal are unpredictable and at times unsatisfactory This factor is of importance only in benign lesions. In the case of a malignant new growth the unsightly scar can be improved later by excision and grafting or by abrasive approaches. The same is true in the treatment of localized granuloma where prompt surgical removal may eradicate a focus and prevent dissemination of the infection

10

Electrodesiccation and Curettage

Norman N. Epstein, M.D.

This chapter is confined to the use of curettage followed by electrodesiccation in the treatment of skin lesions. A simple inexpensive instrument is adequate. The spark produced should be of an intensity range from that which might be used for epilation to one intense enough to produce rapid occlusion of the ordinary blood vessels found in the skin and subcutaneous tissues. For this purpose the instrument should have two outlets, one of lower intensity and one for the stronger current. A heavy pointed electrode will be found suitable for general use. A foot switch is desirable.

Figure 60 illustrates a suitable instrument for electrodesiccation for office use. It is encased in a small container which is of light weight and can be placed on the wall near the operating table. It contains a transformer and rheostat for controlling the current. On the right side are two outlets for monopolar high frequency electric currents, one of which is much stronger than the other. The intensity of the current can be regulated further by adjusting the rheostat on the face of the instrument. A colored glass indicator shows when the current is passing into the active electrode. In addition there are outlets on the right side for electrocoagulation. On the left side is an outlet for a foot switch which allows the operator a more immediate control of the spark.

In performing the procedure of curettage the surgical set up should include dermal curets of varying sizes. Figure 60.4 illustrates a variety of such curets. The operator soon learns what size and which type he prefers for a given operation. For small superficial lesions, he may select a curet with a small cup, i.e., 3 to 5 mm in diameter; for larger more indurated lesions a curet with a larger cup, i.e., 6 to 8 mm in diameter, while for a large superficial lesion a curet about 1 cm in diameter may be preferred.

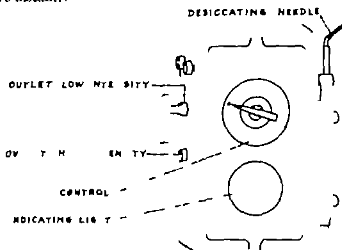
The surgical tray should include instruments for local anesthesia. A metal dental syringe into which tubes of per cent procaine can be fitted is more durable than a glass syringe. Hemostats, scissors, forceps and sponges complete the setup. Small bottles containing 10 per cent formalin or Zenker's fluid should be available for specimens to be submitted for histologic examination.

Operative Procedure

The area is cleansed with 0 per cent alcohol and dried thoroughly. The application of the desiccating spark to an area moist with alcohol will ignite the inflammable alcohol. Strict anthepsis is not necessary. Sterile

instruments are employed but the operator prepares his hands simply by washing with soap and water. Application of antiseptic solutions to the hands and/or sterile gloves are not required.

The lesion to be removed is outlined and its furthest borders noted. The anesthetic is injected intradermally over the extent of the lesion and peripherally to insure anesthesia over the entire area which is to be destroyed. Curetting can be performed immediately as the anesthesia becomes effective instantly.



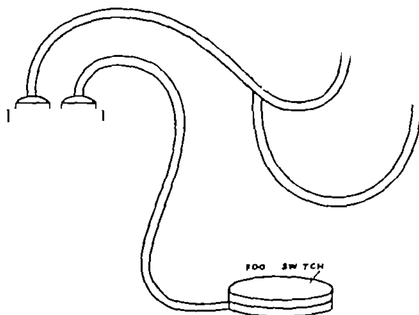
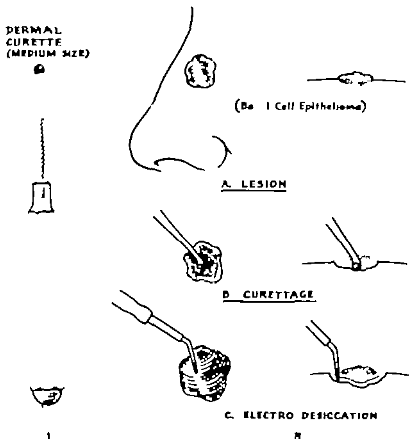


Fig. 65.—A simple apparatus for electrodesiccation.

Curettage is then done and all of the abnormal tissue is removed The technique of curettage consists in the forcible application of a sharp curet into the border of the lesion to be removed By a scraping action the diseased tissue is lifted out. The process is continued until the curet comes in contact with firm normal tissue Epitheliomatous, keratotic and warty tissues are softer and more friable than the normal in the base and sides of the area in which it has developed The curettage will result in



FIGS. 66A and B — Treatment of basal cell epithelioma by curettage and electrodesiccation.

the removal of this type of tissue until no further suspected abnormal tissue can be noted grossly The electrodesiccating current is then applied to the curetted area. The depth of the electrodesiccation will vary with the extent and depth of the lesion. When the lesion is removed for cosmetic purposes such as a nevus a minimum of desiccation should be performed A depressed scar may be as disfiguring as the nevus itself In treating an epithelioma cure is the essential purpose and the cosmetic result is of secondary importance It must be remembered that in desic

cating small lesions such as spider angiomas, verrucæ planæ etc., a small depressed scar may result

Clinical Application

Conditions Amenable to Electrodesiccation alone.—Electrodesiccation may be employed without curettage for the treatment of those lesions which do not require pathologic examination (biopsy) which are small and where it is important from a cosmetic standpoint to destroy as little tissue as possible. Among the lesions amenable to such a procedure are spider angiomas filiform warts, digitate warts, flat warts, small condyloma accuminata non-pigmented nevi seborrheic keratoses, superficial senile keratoses xanthelasma superficial leukoplakia discrete nodules of a lymphangioma adenoma sebaceum sebaceous adenomas and hydrocystomas.

The clinical diagnosis of these lesions is readily made There are certain advantages to desiccating these usually without anesthesia. There is no hemorrhage In the case of verrucæ the spreading of the causative virus is avoided The desiccation is done to a minimum depth and the procedure can be executed rapidly

Conditions Amenable to Curettage and Electrodesiccation.—Curettage followed by electrodesiccation is employed when a specimen is desired for pathologic examination where the depth and extent of the lesion is not obviously clinically and in the treatment of neoplasms suspected of being malignant. The essential principle in the application of this form of therapy is to employ the curet to remove all of the diseased tissue first The operator soon learns the "feel" of the normal as compared with that of the abnormal The term pulpy describes the character of a keratosis which has undergone malignant degeneration With the curet this pulpy or friable or soft character of epitheliomatous tissue is detected readily Curettage is continued until the base of the lesion is firm and all pockets of abnormal material have been scraped away This is followed by electrodesiccation to destroy any abnormal cells which may be present at the base or sides of the operative site and for the purpose of hemostasis. The curettings are adequate for pathological examination The depth and extent of the electrodesiccation will depend on the type of the lesion under treatment In the case of a benign lesion the desiccation will be the minimum required to destroy the lesion itself When it is epitheliomatous complete eradication of the growth is essential The cosmetic appearance of the end result of treatment is of secondary importance Each case must be individualized but as a rule the desiccation should extend at least 0.5 cm beyond the curetted border The base should be desiccated also to a depth of 0.3 cm if malignancy is suspected This suggestion can be followed only if the lesion is so situated that sufficient tissue is available for the destruction of this amount Obviously a tumor at the inner canthus the eyelid adjacent to the external auditory canal over bony prominences etc will pose anatomical problem which will make it impossible to desiccate to the extent indicated above When a lesion is situated in a position where adequate curettage and electrodesiccation cannot be applied some other form of therapy should be instituted

Post-operative Care.

The wound produced by electrodesiccation and curettage heals by secondary intention granulating in from the base. As the granulation tissue approaches the surface of the skin, it becomes epithelialized. The electrodesiccation produces a dry necrotic crust which covers the wound. This crust remains dry for two or three days. Then exudation occurs and the crust sloughs in seven to ten days leaving a moist surface. In the case of large lesions, a second or a third crust may form. Slight capillary bleeding may occur as the primary crust sloughs. Considerable hemorrhage may result if an artery is ruptured at the time of the primary slough. This is not uncommon when the electrodesiccation and curettage are done in the region of large blood vessels such as on the lips, the buccal mucosa, the scalp, the temple, etc. This should be watched for and every effort made to prevent premature removal of the crust in order that such vessels shall be thrombosed completely before separation of the crust. The patient should be warned of this possibility and instructed to protect the crust from undue injury.

The wound is left open since dressings promote secondary infection and slow healing. An antiseptic powder such as 3 per cent ammoniated mercury in talc is an excellent local application. If secondary infection develops, warm boric acid compresses may be used. Antibiotics, internally or locally, may be useful in severe infections. If the granulations become exuberant, epithelialization can be hastened by their cauterization with 20 per cent silver nitrate solution. The time required for complete healing will vary with the size, depth and location of the wound. When the removal is done in an area with good blood supply and with an abundance of subcutaneous tissue such as the cheek, healing will be more rapid than when done on the back of the hand, the helix of the ear or the bridge of the nose. The age of the patient is also a factor as elderly patients tend to heal more slowly. It should be noted that hemostasis is a greater problem in the aged than in younger patients. For this reason the desiccation may be more intense to control hemorrhage in older people and thus produce a deeper more slowly healing wound. One to six weeks is required for the healing of wounds produced by electrodesiccation and curettage.

Post-operative Scars.

Healing results in scarring of varying degree. The amount and character of scar tissue depends upon the size, depth and location of the area treated. In addition, the tendency of the individual to form keloid or hypertrophic scars must be taken into consideration. Small lesions treated by superficial electrodesiccation leave a reddish, slightly thickened discoloration which within a period of two to six weeks takes on an appearance approaching normal skin. Large lesions heal after electrodesiccation and curettage with considerable scar formation which is reddish in color and hypertrophic in character at first. It may be raised and sensitive. This type of scar formation often resembles the original tumor and the clinician may be uncertain as to whether a recurrence of the neoplasm has developed. This problem arises more commonly when the patient is seen for the first time by a physician other than the operator. The person who

did the surgery is best qualified to judge whether he accomplished a thorough and complete eradication of the lesion. The final decision in this problem can and should be made only after a period of several months of observation. Where electrodesiccation and curettage has been applied thoroughly at least six months should elapse before the clinician decides that the result has been unsatisfactory. I have seen a number of these scars excised in the belief that the tumor had not been eradicated. In each instance the specimen was free of epithelioma. As a rule the scar gradually softens and diminishes in size and finally becomes atrophic and pliable.

When a lesion is removed from an area where the normal contours of the skin have been disturbed, such as the nasolabial fold, there is a marked tendency for even large residual scars to become linear in character. This may be so striking as to lead to the conclusion that the lesion had been removed by scalpel excision. This end result may require two to five years. In certain areas of the body where the skin is under tension electrodesiccation and curettage may be followed by keloid formation. This is true particularly of the deltoid and anterior chest regions.

In general it may be stated that scars following electrodesiccation and curettage tend to improve progressively with time, reaching their best appearance in one to five years. This is in contrast to scars produced by radiation.

Therapeutic Results.

The therapeutic results obtainable by electrodesiccation and curettage are comparable to those which follow any other modality used for the removal or destruction of skin lesions.

Seborrheic and senile keratoses respond well. They are rapidly and effectively removed by electrodesiccation and curettage and the cosmetic results are satisfactory. Recurrence after the proper application of this method is uncommon.

Verrucae of various types are treated satisfactorily. However, being of viral causation the tendency for recurrence is about the same as when other destructive measures are employed.

Pigmented and hairy nevi can be removed effectively by electrodesiccation and curettage. Inasmuch as the hair follicle is deep in the skin, complete removal of the hair bearing portion may result in a depressed scar. If electrolysis is done previous to the electrodesiccation, the cosmetic results are better.

Electrodesiccation and curettage is an excellent method for removal of epithelioma. The selection of the cases to be treated is of utmost importance. Only those tumors should be removed in which an adequate border can be destroyed. The location of the lesion will determine this. For instance, a lesion at the inner canthus of the eye may be so situated as to make it impossible to remove it *in toto* with sufficient border. A lesion may be near the external auditory canal and a similar difficulty might exist. Other locations which may pose similar problems include the nasolabial fold, the ala nasi, the oral commissures, etc. The depth of the growth is another factor which may contraindicate the use of electro-

desiccation and curettage Lesions which extend deep into the subcutaneous tissues are not suitable for this procedure. Neoplasms which encroach upon bony structures sinuses or cavities are unsuitable for electrodesiccation and curettage.

When a lesion of the lip extends into the musculature other methods of treatment are preferred Where a lesion has developed in an area of skin which might not heal properly such as in an area of radiation dermatitis or scar tissue other methods of removal are advisable This applies also to lesions on the back of the hand which tend to heal slowly

The size of an epithelioma, also may influence the decision as to whether to employ electrodesiccation and curettage A tumor which is over 3 cm in diameter is probably too large for this form of treatment The exceptions to this include superficial plaques of basal cell epitheliomatosis. Large seborrheic keratoses may be removed by curettage and superficial electrodesiccation also

If one follows the above suggestions as to selection of cases and employs curettage and electrodesiccation properly cure of epitheliomas should be effected in 98 per cent plus of the cases. Recurrences have been rare in my experience There are those patients who develop epitheliomas (basal cell type) adjacent to treated areas in spite of the method of treatment employed These patients have an epidermis which produces multicentric foci of epithelioma at a distance from the original lesion and thus continue to form neoplasms regardless of how radical the original treatment may be There seems to be an irreducible percentage of failure in the treatment of epithelioma which is probably 1 to 2 per cent.

The fact that electrodesiccation and curettage is an office procedure that it can be done rapidly and without previous preparation and that it is not costly are advantages in the treatment of epitheliomas. Because of these fact the patient rarely leaves the office without having his lesion removed This avoids loss of the patient during the delay necessitated by performing surgical procedures in a hospital

11

Epilation

Charles S. Lincoln, Jr., M.D.

THE presence of disfiguring hair on the face and occasionally on the arms and legs is a cause of concern to many women. Occasionally a man will present himself with what he considers to be unsightly hair growth, for example, between the eyebrows. Even children may have certain bizarre nevi or birthmarks composed of hair that are most distressing to the parents, if not to the patient.

Many methods for removal of this unwanted hair have been advocated, such as epilating waxes, chemical depilatories, plucking, and shaving. Often bleaching with hydrogen peroxide will make dark hairs so much less noticeable that actual removal is not cosmetically necessary. All the above mentioned methods are acceptable. The use of *x*-ray for the removal of hair, except temporarily in the treatment of certain fungus infections of the scalp and beard, is far too dangerous and is never used.

At the present time there are only two safe and cosmetically acceptable methods for the permanent removal of superfluous hair: (1) epilation by the high frequency current or (2) surgical galvanism (electrolysis).

Arguments are still heard over which of the two methods is the better. It is enough to say that both methods give excellent results when properly applied, and as stated in a previous chapter on scalpel surgery, the best method is the one in which the operator is most skilled.

Very few physicians indeed will find they have the time, the patience, the eyesight, or the ability to epilate on a large scale, and usually will be happy to refer these individuals to a professional epilator. To date I have not had a complaint from a patient handled in the latter manner. Some prefer to train members of their office personnel to perform this operation with gratifying results.

On the other hand, the correction of a mild hypertrichosis or the removal of a number of occasional hairs, especially if they are coarse and black, such as may be found arising from a mole or spontaneously on various areas of the face, should be in the scope of any dermatologist and the technique may be easily mastered by most practitioners.

EPILATION BY THE HIGH FREQUENCY CURRENT

This method is mentioned first because of its increasing popularity, which can be attributed to the great saving in time over electrolysis, the reduced pain, and in my mind, most important, the universal availability of a high frequency electrodesiccating apparatus. Most sparkgap machines that furnish a desiccating current may be employed, such as the Hy-

frecator (Fig 67) or the Bovie unit, an important accessory found in almost any physician's office. For such machines special epilating needles are available which fit the standard needle holder Most machines have a foot switch or less often a switch in the needle holder With this a pair of forceps, along with good lighting is all that is required A 75 to 100 watt bulb in a flexible reflector is adequate Some individuals require a magnifying device such as a binocular loupe which is inexpensive and very helpful for treating fine blond hairs.

All patients upon making an appointment for epilation should be advised *to allow the hairs they want removed to grow and refrain from plucking* or clipping them short.



Figure 67 —Epilation using the Hyfrecator Note the binocular loupe for magnification No ground is used with this machine.

If more than a few hairs are to be removed it is most important that the operator as well as the patient be as relaxed and comfortable as possible At best epilation is a tedious and painful process. The sensitive individuals, and even the stoics, appreciate pre-operative sedation. Usually a fast acting barbiturate with or without aspirin will suffice These patient should be accompanied to the office by someone capable of driving them home

A local anesthetic such 2 per cent procaine solution injected by infiltration may be used for epilating very small patches or hairy nevi

Technique —First the patient's face should be washed liberally with soap and water followed b gentle sponging with 0 per cent alcohol. The operator should likewise scrub his hand with soap and water Th needle to be used is terilized in 70 per cent alcohol.

The operator now seats himself for the most comfort and range of movement. He should be well elevated at the head of the treatment table on which the patient reclines.

A towel may be placed upon the patient's chest with a few sterile sponges and the forceps. As the hairs are epilated they should be placed in a group on the towel or sponge as it may be difficult, especially in the individuals with many fine hairs, to ascertain that any epilation has been accomplished. A show of the removed hairs will be convincing.

The high frequency desiccation apparatus to be used is set usually at the lowest reading that will produce a spark. This is best determined previous to use by wetting the fingernail and bringing the electrode almost to the nail surface, gradually turning up the intensity control until a tiny spark is produced. There is no pain but a gradual perception of heat is noted. The operator can be forgiven for being timorous on the first few calibrations. There is a great variation in all electro-surgical equipment, even in identical models, and unfortunately there is variation from day t[o] day depending on line flow and humidity. It is most important to *know the machine you are using*. Some machines produce a strong spark when set on zero and would not be suited for epilation. Special resistance coils can be obtained for certain makes to reduce their output.

With everything ready the epilation needle is slipped into the hair follicle parallel to the hair without force until the bottom is reached. This is not a difficult as it may sound. Some variation in the angle of the hair follicle will be encountered. In many areas this may be almost parallel to the skin surface and possibly only on the point of the chin will the follicles be found to run at right angles to the skin. There should be no resistance to the introduction of the needle into the follicle and it should slide easily until a slight resistance is encountered. The depth of the insertion varies with the depth of the follicle. If performed correctly this stage is painless. With the needle in place, the foot or thumb switch is pressed for the count of one, two, about one second, after warning the patient that there will be a stinging sensation. This must not be severe. The foot is again pressed for another second, released, and pressed again. The number of applications varies slightly depending upon the diameter of the hair. However more than eight to ten seconds is seldom required. Breaking the circuit after each second of treatment gives the operator more control. With experience a single application of from six to ten seconds will reduce the total treatment time. It is wise to choose hairs of the same size for each treatment period, that is, do the coarse hairs first, medium, and then fine. Under these circumstances each hair will require approximately the same treatment time on any given day.

[illegible] ith the tweezers [illegible] asily. When [illegible] hair follicle and no bubbles are formed. It is my practice to pull the coarse long hairs out gently with my fingernails. It is almost impossible to remove an untreated hair in this manner.

Treatment may be carried on for fifteen to twenty minutes in each session. During this period 25 to 50 hairs may be removed, being careful

not to treat over 2 or 3 hairs in an area of 1 square centimeter. Usually one out of three of these will grow back and this should be explained to the patient. Caution should be taken not to leave your foot accidentally on the control switch while inserting or removing the needle as a painful spark will result. A few bleeding points are usually noted where either the follicle has been missed or punctured. There is some redness and swelling post-operatively. Slight pustulation followed by the formation of small crusts may result. Even with great care slight scarring may be noted. It is wise to prescribe an antibiotic or antiseptic ointment, such as bacitracin or 10 per cent boric acid, to be used two or three times daily after the epilation is performed.



Figure 68.—The Wappler direct current apparatus that works from an alternating current. This machine has no hand or foot switch. Contact is made by the patient, who will be noted touching the ground, round brass tube with her right hand. The milliammeter reads a little over 0.5 milliamperes.

Epilation by Electrolysis

The technique for the use of surgical galvanism for the removal of superfluous hair is quite similar to electrodesiccation, the major variation being in the equipment and the greater time required.

Machines supplying a direct current by rectification may be purchased that will work directly from a source of alternating current. The Wappler (Fig. 68) is such a machine. Care must be taken not to touch a ground source, for example a water faucet, while holding the grounding electrode of the machine once it is plugged in, even though switched off, as a rather severe shock may result. I have inadvertently made this mistake.

A smoother direct current is produced by battery machines which likewise may be purchased or, being relatively simple, may be constructed by

anyone so inclined Photographs (Fig 69) have been taken of such a model with a hinged top (69 1) so that the circuit may be followed during the description of its construction.

The machine consists of a small light wood or plywood box, measuring approximately 10 × 10 inches square and 5 inches high preferably with a hinged top for storage of accessory parts. In this is placed a 22½ volt or a 45 volt dry cell battery The 22½ volt batteries are difficult to obtain. The positive pole of the battery is wired to the positive pole of a 0 to 5 milliampere milliammeter Since the average current used is approx

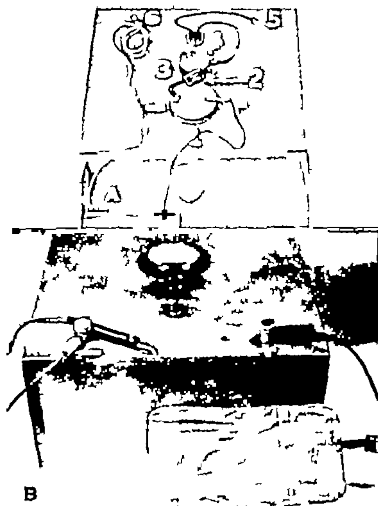


Figure 69. —*A* Electrolysis apparatus open to show battery storage space and wiring. The resistance coil (2) is numbered in white *B* Apparatus closed to show needle holder with switch in the handle needle and grounding plate Note the negative and positive electrodes are plainly marked.

imately 1 milliampere a meter registering from 0 to 50 would be difficult to read At the negative pole of the milliammeter (1) a 50,000 ohm resistance coil (2) is attached which is in turn wired to a rheostat (3) The rheostat is connected to a switch (4) which is connected to the positive or dispersive electrode terminal (5) From the negative pole of the battery a wire is run directly to the negative or active electrode terminal (6)

The active electrode which is always connected to the negative pole or terminal (Fig 69) consists of a light insulated flexible wire about 4 feet long which terminates in a light weight needle holder with a thumb switch and a fine steel or platinum needle The positive, dispersive, or inactive electrode likewise is an insulated wire of about the same length that need not be so flexible or light which terminates in a felt sponge or flat metal plate which is used to ground the patient.

With a machine set up as described with a single new full strength 22½ volt battery and 50,000 ohms resistance with the rheostat set at 0 the milliamperemeter will read about 4 milliamperes. This is doubled with a 45 volt battery By increasing the resistance through the rheostat the current may be reduced as desired

To test polarity both electrodes are immersed in a vessel containing salt water (tap water with a pinch of salt) If the polarity is correct the needle or negative electrode will rapidly give off many fine bubbles of hydrogen gas. If this is reversed there will be no bubbles or a very few large bubbles of oxygen may be noted Red litmus paper wet with distilled water will turn blue if touched with the negative electrode If a platinum needle is used polarity makes no difference

Technique —Again the patient and operator prepare themselves as described under high frequency epilation

The positive or dispersive electrode if a felt pad is used is wet with tap water *or saline and pressed into the patient's palm Should a metal plate* be used it is covered by a towel similarly wet upon which the patient open palm is placed. The needle is now inserted into the hair follicle using the right or left hand accordingly the tweezers or forceps being held in the other hand The circuit is closed by pressing the thumb switch Certain models have a foot switch. If no switch is provided the ground (Fig 68) may be used to break the circuit When you wish the circuit closed request that the patient's hand be pressed into the felt pad or onto the grounding plate This establishes a complete circuit At this point it may be necessary to adjust the rheostat so that from 0 to 1 5 milliamperes register From previous experience the approximate setting is usually determined

If the needle is properly placed in the follicle tiny white bubbles of hydrogen appear about the base of the hair After the frothy bubbles appear allow the current to flow three or four seconds longer break the circuit and pull the hair out with your fingernails or with tweezers. At first it may be necessary to pull gently on the hair from time to time during treatment to determine when the follicle has been destroyed Following the removal of a few hairs the setting of the milliamperemeter and length of time required will be established In general the heavy coarse hairs require more current and time It is seldom necessary to exceed 1

milliamperes for thirty seconds On the upper lip which is very sensitive especially near the nose less than 0.5 milliampere is used for the same length of time

Complications are few There may be bleeding which is due to poor technique and indicates the follicle has been missed or punctured A tattoo resulting from using a steel epilation needle connected to the positive poles can be avoided easily by care and proper marking of the terminal wires.

In treating hairy moles the hairs should first be removed which in itself may cause the mole to disappear A non-hairy mole or the remnant of the mole after epilation may be treated by transfixing with the electrolysis needle The needle is inserted into the center of the mole parallel to the skin a little above the normal skin surface and 1 to 2 milliamperes current allowed to flow for thirty to sixty seconds until the needle is well surrounded by a white discoloration *This process is repeated at right angles to the* original insertion in a criss-cross pattern For small moles this will usually be adequate For larger moles a parallel insertion on each side of the criss and the cross forming a mesh-like pattern may be necessary Often this treatment must be repeated in two or three weeks for a complete removal

Spider nevi are treated by inserting the needle into the central vessel and allowing a 1 to 2 milliampere current to flow until the area about the needle becomes white and blanched For small spider nevi the radiating vessel will disappear spontaneously If further treatment is necessary the electrolysis needle is inserted into the course of the vessel at right angles to the skin surface and again 1 to 2 milliamperes of current allowed to flow The vessel very rapidly turns white and the red cells can be observed being pushed out of the vessel by the bubbles of hydrogen. This is repeated every millimeter or two to the termination of the vessel. Telangiectases and dilated venules are treated in exactly the same manner Small hemangiomas are treated simply by inserting the needle straight down into the center of the lesion and allowing 1 to 2 milliamperes of current to flow until the entire lesion is blanched

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PART III SPECIAL TECHNIQUES

12

The Chemosurgical Method for the Microscopically Controlled Excision of Cutaneous Cancer

Frederic E. Mohs, M.D.

It has been demonstrated that many cutaneous cancers send out irregular clinically unpredictable outgrowths into the adjacent tissues. In order to follow out these "silent" extensions reliably and yet conservatively the chemosurgical method was devised to provide complete microscopic control of excision.

TECHNIQUE

Essentially the chemosurgical technique consists of three steps (1) chemical fixation *in situ* of the tissues suspected of being cancerous, (2) excision of a layer of fixed tissue and (3) systematic microscopic examination of the excised layer by means of frozen sections. The process is repeated in the areas demonstrated to be cancerous until a completely cancer-free plane is reached. The essentials of the technique as used in a case of basal cell carcinoma of the inner canthus are given herewith.

The patient had an ulcerated indurated lesion which measured 10 × 15 mm (Fig. 70.1). The neoplasm had been treated with radium on three occasions, the last being a year prior to his entrance to the Chemosurgery Clinic. There was indefinite induration in the adjacent tissues but it was impossible to determine clinically whether this represented cancer or scar from the previous treatment.

The first step was the application of a keratolytic chemical (dichloracetic acid) to the skin over the central part of the indurated area. This produced *whitening of the skin due to the coagulation of the protoplasm of the* cells of the stratum spinosum. The change in color served to indicate penetration of the stratum corneum, the keratin otherwise would bar the passage of the fixative chemical.

The fixative chemical was zinc chloride which composed 4[illegible] per cent by weight of a paste of the following composition

Obtained from the Eastman Kodak Company

Stibnite, 80 mesh sieve	40.0 gm.
Sanguinaria canadensis	10.0 gm.
Zinc chloride, saturated solution	34.5 cc.

A layer of the paste 1 mm. thick was applied to the portion of the lesion that was definitely indurated. The fixative paste was held in place by a layer of nonabsorbent cotton and the whole was covered with a layer of gauze-backed cotton on which petrolatum had been spread to make an occlusive dressing. The dressing was fastened in place with quarter-inch strips of adhesive tape. Codeine phosphate 30 mg. and acetylsalicylic acid 0.65 gm. were ordered to be given every three hours as needed.



Figure 70 — A. Basal cell carcinoma which had recurred after three radium treatments. *B.* Final layer of fixed tissue after chemosurgical excision in four microscopically controlled stages (*Fig. 71*). *C.* Granulation tissue and exposed nasal bone after seven days. *D.* Healed lesion after four months.

On the next day a 2-mm. layer of fixed tissue was excised. This caused no pain or bleeding because the incisions were made through fixed tissue. Vertically-cut frozen sections revealed that the excised tissue was full of basal cell carcinoma. Dichloracetic acid was applied to a 1-mm. zone of skin at the periphery and the zinc chloride fixative was reapplied to the entire area.

On the next day a 2-mm. layer was excised. Since no cancer was discernible grossly at this level the entire layer of tissue was saved for microscopic examination by means of frozen sections cut through the under surface of each of the five specimens. On a pad of paper a map was drawn to correspond with markings made with mercurochrome on the surface of the fixed tissue remaining on the wound. Much of the area was found to be cancerous (Fig. 71 A). Reapplication of the fixative, it is important to note, was limited to the cancerous areas. On the next day the cancer was

localized to a small area of the lesion (Fig. 71B). The fixative was reapplied to this area and the next excised layer of fixed tissue was found to be free of cancer (Fig. 71C). In this case the microscopic examination of the excised layers of tissue revealed a considerably larger area of cancerous involvement than the original examination had suggested (Fig. 70B).

Seven days later the final 1 mm. layer of fixed tissue was loose so that it could be dissected off with the exposure of well vascularized granulation tissue except in an area where the nasal bone was exposed (Fig. 70C). The granulation tissue gradually covered the bone which was left in place because the previous irradiation had slowed the rate of separation. (Bone usually separates within three weeks after fixation.) The wound which was dressed with scarlet red ointment-impregnated gauze healed uneventfully with a good cosmetic and functional result (Fig. 70D). In cases in which a plastic repair is necessary the well vascularized tissues following chemosurgical treatment provide excellent conditions for healing.

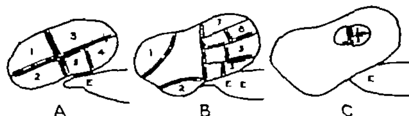


Figure 71.—Maps showing origins of specimens removed on the second, third and fourth excisions from the lesion pictured in Figure 70. Microscopically located areas of cancer are stippled.

The period of active treatment could have been reduced from four to two days in this case by the use of twice-daily or thrice-daily excisions. Further reduction in the period of treatment would have resulted from preliminary removal of the grossly visible portion of the neoplasm under local procaine anesthesia. However, in this case in which the cancer had almost penetrated the upper eyelid, it was felt that the edema produced by the initial application of the fixative would be advantageous in that it would increase the effective thickness of the eyelid and provide an extra margin of safety during the later stages of chemosurgical treatment. Therefore the initial surgical excision was omitted.

However, in most cases in which there is an appreciable amount of grossly visible and palpable carcinoma, the main mass is excised surgically prior to the institution of chemosurgical treatment. Usually this preliminary excision is carried out by means of a cold scalpel but not infrequently it is convenient to use a curet as suggested by Dr. R. R. Allington. Following the surgical excision of the main mass, hemostasis is secured by the rapid application of dichloracetic acid to the uncauterized wound (Figs. 73B and 81B). The zinc chloride fixative then is applied and the microscopically guided chemosurgical excisions are made as outlined above.



Figure 72 — A. Basal cell carcinoma which had recurred after electrodesiccation and two courses of roentgen therapy. B. Lesion at completion of chemosurgical excision in nine microscopically controlled stages. The final layer of fixed tissue is still in place. The [illegible] and irregular peripheral spread of the cancer [illegible] almost entirely in the dermis. C. Granulation tissue after separation of the fixed tissue. D. Healed lesion. Note the smooth, non-conspicuous scar. There [illegible] no recurrence after five years. E. Photomicrograph of frozen section of skin at the periphery showing the slender [illegible] strands of carcinoma in the dermis.

INDICATIONS

The microscopic control of excision afforded by the chemosurgical technique is advantageous in the treatment of almost all malignant neoplasms of the skin. Also it is useful in the treatment of certain neoplasms originating under the skin as well as cancers located in cavities which are sufficiently accessible through normal pathologic or artificial openings. However these indications are not within the scope of this book. Some of the chief uses of the method are discussed and illustrated in the following sections.

Carcinoma of the Face, Scalp and Neck.

Carcinomas of the non-orificial regions of the face are relatively easily removed by means of the chemosurgical technique because there are none of the complicating factors that must be coped with in the treatment of



Figure 73. — A. Basal cell carcinoma. *B.* Nonvertised wound after surgical excision of the grossly detectable mass and cauterization with dichloracetic acid. Two more layers were chemosurgically excised before a microscopically cancer-free plane was reached. *C.* Granulation tissue after separation of the final layer of fixed tissue. *D.* Healed lesion. There was no recurrence after t years.

cancers of the eyelids, nose, ears and other circumorificial tissues. However facial carcinomas frequently exhibit silent outgrowths from the grossly detectable mass. Probably the most common example of such unpredictable extension is the peripheral spread in the dermis which is frequently observed especially in the more highly invasive basal cell carcinomas of the temples and forehead (Fig. 7). Neoplasms which exhibit this particular affinity for dermis often do not extend for an equal distance in all directions. For example silent dermal invasion may extend for 2 mm. at one edge and for 20 mm. at the opposite edge. Hence the microscopically

controlled excision is invaluable in assuring complete removal of such lesions without destroying large amounts of normal tissues.

In cases in which most of the cancer is submerged as in the cases illustrated in Figures 70 and 72 the microscopically controlled excisions may be required right from the beginning of treatment. However in many cases there is a clear-cut mass of cancer which obviously must be removed (Fig 73A) The preliminary surgical removal of this portion saves time and reduces the discomfort. Procaine hydrochloride solution is injected into the tissues surrounding the neoplasm care being exercised to avoid passing the needle through the cancer tissue Then the main mass is excised with a scalpel following which the saucerized wound is cauterized with dichloracetic acid to control the bleeding (Fig 73B) The fixative then is applied and the rest of the neoplasm is removed chemosurgically in order to secure the advantages of the microscopic control of excision (Figs 73C and D)

Reflecting the freedom of complications in the chemosurgical treatment of carcinoma of the non-orificial regions of the face scalp and neck are the excellent end results In a consecutive series of 404 patients with basal cell carcinomas the five-year rate of cure was 100 per cent while in a series of 230 patients with squamous cell carcinoma the five-year rate of cure was 84.8 per cent

CARCINOMA OF THE NOSE.

Many nasal carcinomas are relatively highly invasive neoplasms which send out slender extensions into the surrounding tissues. Since the fibrocartilaginous tissues of the nose have almost the same consistency as these strands of cancer tissue it is particularly difficult to estimate the exact extent of the neoplasms in this region by palpation. Hence, microscopically controlled chemosurgical excision is especially valuable This is particularly true in cases of the highly invasive basal cell carcinomas which invade deeply the embryologic fusion plane in the region of the nasolabial fold However carcinoma of either basal or squamous cell type located in other parts of the nose also may invade more widely or more deeply than expected (Fig 74) No matter how extensive the involvement of the nose the neoplasms can be selectively followed to the terminations of their smallest outgrowths (Fig 75) Defects necessarily result in the more advanced cases but the preservation of maximal amounts of normal tissues facilitates the subsequent plastic repair The repair may be carried out immediately after chemosurgical treatment unless there is a question of outlying foci of carcinoma such as may be present following previous unsuccessful surgical or radiation treatment.

CARCINOMA OF THE EYELIDS.

Chemosurgical treatment of carcinoma of the eyelid can be carried out without endangering the eyeball unless there is invasion of the sclera In the latter event enucleation may be required unless the involvement of this layer is minimal Factors which help to protect the eye during treatment of eyelid lesions are (1) chemical edema and chemosis which tend to push the treated area away from the eye and provide an extra margin of

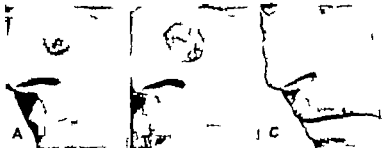


Figure 74.—*A* Squamous cell carcinoma, grade 3 malignancy. *B*, Granulation tissue after chemosurgical excision. The frozen sections from the deepest level contained cancer cells among the mucosal glands. The mucosa itself was not invaded, hence it was preserved. *C* Healed lesion. There was no recurrence after ten years.

Figure 75.—*A* Basal cell carcinoma which had recurred after electrodesiccation, radium plaques, roentgen rays, radon seeds and surgical excision with plastic repair. *B* Granulation tissue after chemosurgical excision. The highly invasive carcinoma invaded much farther than expected in the root [illegible] the septum and [illegible] the left cheek. However, the columella and the right nares were preserved. *C* Healed lesion just prior to reconstruction of the nose. *D* Appearance after part of reconstruction had been completed. There was no recurrence after twelve years.

safety and (2) the flow of tears which carries away the chemical as fast as it penetrates through the eyelid This prevents the accumulation of harmful concentrations of the fixative even when penetration through the full thickness of the upper eyelid over the cornea is necessary

Inner canthal carcinomas often invade posteriorly for some distance along the periosteum of the medial wall of the orbit Usually these extensions can be followed back to their terminations without damage to the eyeball. Following chemosurgical treatment the inner canthal lesions heal well with satisfactory functional and cosmetic results (Fig 70) Only when there is appreciable destruction of the adjacent upper and lower eyelids near the commissure is there likely to be separation of the medial ends of the eyelids. This separation may be prevented by a medial tarsorrhaphy which should be done as soon as the final layer of fixed tissue has separated



Figure 6 — A Pigmented basal cell carcinoma. B Granulation tissue after surgical excision of the main mass t chemosurgical excision and, finally t surgical excision of an outgrowth which extended 5 mm. laterally just under the conjunctiva at the lid margin C Healed lesion. Note how the eyelid had pulled up t normal position. There no recurrence after t years.

Carcinoma of the lower eyelid usually is of the basal cell type Ordinarily the main mass is surgically excised without removing the tissues at the lid margin This produces a depression in which the fixative may be placed without danger to the eye After a microscopically cancer-free plane has been reached everywhere except at the lid margin the tissues are removed from the latter region for microscopic examination If it becomes difficult to use the fixative because of the tears carrying it into the eye it is possible to complete the excision surgically after the injection of a local anesthetic The surgical specimens if small can be rapidly fixed by heating in formalin and frozen sections made to provide microscopic guidance the same as is done with the chemosurgical technique The tissues of the lower eyelid have a remarkable tendency to pull up into normal position as scar contraction takes place (Fig 76)

Unless very large, carcinoma of the upper eyelid may be removed without noticeable defect (Fig. 77). This is true because there is a considerable excess of loose skin which can pull in and cover a considerable area of denudation. If the cancer invades the full thickness of the eyelid, it is necessary to produce a hole through the structure. However, there is no danger of damaging the eye because the tears carry away the fixative as fast as it permeates through the eyelid. The hole, if small, closes spontaneously but, if large, may require closure with sutures. If the entire



Figure 77 — A Basal cell carcinoma, nodular, relatively noninvasive type. *B* Granulation tissue after chemosurgical excision. *C* Healed lesion. There was no recurrence when the patient died of other causes after one year. *D* Frozen section of the basal cell carcinoma. The tissue was fixed with zinc chloride.

upper lid must be removed, the lower lid is sutured over the eyeball to protect it from exposure. Later it may be possible to split the lower lid so that upper and lower eyelids are formed.

Unless too extensive, lateral canthal lesions may be removed without damage to the eye (Fig. 78). However, since there is not much space between the rim of the orbit and the eye, it is important that lesions in this region be treated as early as possible. Otherwise scleral involvement may be so great that removal of the eye becomes necessary.

In a consecutive series of 120 cases of basal cell carcinoma of the eyelids, the five-year rate of cure following chemosurgical treatment was 93.4 per cent while in a series of 18 cases of squamous cell carcinoma of the eyelids the five-year rate of cure was 92.9 per cent.

CARCINOMA OF THE EAR

Carcinoma of the external ear may be excised chemosurgically with assurance of elimination of the neoplasm and yet with preservation of maximal amounts of uninvolved tissue. The latter consideration is important because the repairs of large defects of the ear often are unsatisfactory.



Figure 78. — A, Basal cell carcinoma. B, Granulation tissue after chemosurgical excision. C, Healed lesion. There was no recurrence after three years.

If the cancer is small it may be possible to remove it chemosurgically without affecting the underlying cartilage. However, most lesions have reached the perichondrium by the time the patient reports for treatment. In such cases the cartilage acts as a barrier to the deeper extension of the cancer though peripheral extension in the perichondrium often occurs. When the cartilage has been exposed, frozen sections of the tissues at the periphery are all that are necessary (Figs. 79 and 80). Care must be exercised to limit the penetration of the fixative through the cartilage lest a defect through the full thickness of the ear be produced unnecessarily. Advanced lesions may require the removal of much of the ear. If the remnant of the ear tend to hang down in abnormal position, sutures may be used to hold the fragments in place until they become stabilized (Fig. 81).

Lesions of the helix often may be removed conservatively avoiding the formation of a niche. In some cases in which a defect necessarily is produced, a satisfactory cosmetic result can be obtained by smoothing off the sharp edges of the niche. In other cases it is better to save all the uninvolved tissues and repair the defect later.

Following chemosurgical removal of cancers which invade the ear canal there may be some tendency toward stenosis. In some instances closure has been avoided by keeping the canal packed during healing. If it is possible to have the scar contraction pull the tissues peripherally during healing the canal remains widely patent (Fig. 81C).

In a series of 74 cases of basal cell carcinoma of the ear the five-year rate of cure was 94.2 per cent. In a series of [illegible]6 squamous cell carcinomas the five-year rate of cure was 79.6 per cent.

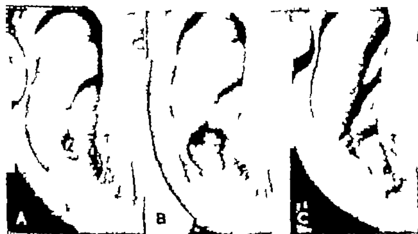


Figure 79.—*A*, Squamous cell carcinoma, malignancy grade 3. *B*, Granulation tissue after chemosurgical excision of the carcinoma [illegible] removal of the cartilage [illegible] the base of the [illegible] (Fig. 80). *C*, Healed lesion. *There* [illegible] *no recurrence* [illegible] *the patient died of other causes after four years.*

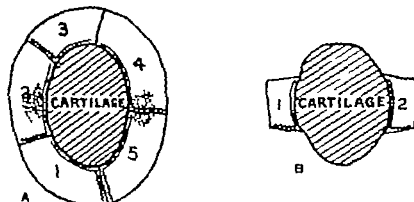


Figure 80.—Maps of specimens removed [illegible] successive excisions from the patient illustrated in Figure 79. [illegible] Stippled area represent [illegible] *of cancer.* *B*, The specimens from the next excision [illegible] *free of cancer.*

CARCINOMA OF THE EXTREMITIES AND TRUNK.

A considerable proportion of the cancers of the extremities occur in doctors and dentists as a result of exposure to roentgen rays. In many cases it has been possible to remove cancers from the fingers of these professional people without loss of function.

Carcinomas on the dorsum of the hand more commonly are the result of exposure to actinic rays rather than to roentgen rays The conservatism which is safely possible with the chemosurgical method permits excellent cosmetic and functional results (Fig 82) Very extensive lesions which have destroyed portions of the metacarpal bones also may be removed with the preservation of sufficient normal structure to retain good grasping function



Figure 81 —*A* Basal cell carcinoma which had persisted despite numerous electrodesiccation treatment *B* Lesion at completion of chemosurgical excision of the carcinoma which underlay the supra-auricular scar and which invaded the upper three-quarters of the ear including the canal. Lacking support, the remnant of the lower part of the ear hung down. This necessitated positioning with sutures tied over rubber dam until the wound healed. *C* Healed lesion There was no recurrence after four years.

Some carcinomas of the legs arise in old burn scars or in chronic ulcers The microscopic control attainable with the chemosurgical technique permits accurate differentiation between the induration from carcinoma and that from scar or inflammatory swelling

The so-called "superficial basal cell carcinomas" are particularly common on the trunk but are not infrequent on the extremities. Since these lesions rarely become deeply invasive it is permissible in most cases of this type to limit the microscopic sectioning to the tissues at the periphery Frequently the peripheral spread is greater in some parts of the edge than is expected from the gross appearance of the lesion.

In a series of 96 consecutive cases of basal cell carcinoma of the extremities and trunk the five-year rate of cure following chemosurgical treatment was 100 per cent. In a series of 100 cases of squamous cell carcinoma the five-year rate of cure was 80 4 per cent

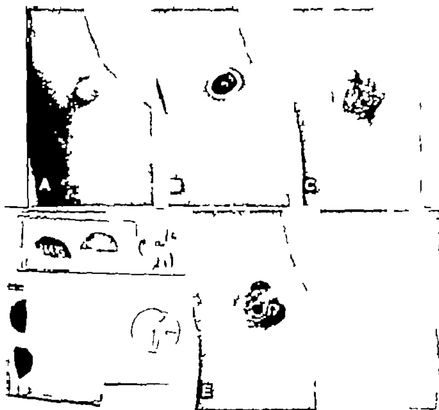


Figure 82.—The stages of surgical and chemosurgical treatment as illustrated ith small, simple lesion. *A* Squamous cell carcinoma, grade 1 malignancy rst. *B* lesion after surgical excision of the grossly visible portion and cauterization of the base and narrow rim of epidermis with dichloracetic acid. The zinc chloride fixative pplied t this surf ce *C* Lesion after excision of layer f tissue hich had been fixed *situ*. Not the mark hich wa made ith mercurochrome t show the origin of the specimens. *C* 1 xcised specimens, th corresponding frozen section and the map showing the origin of the specimens The sections revealed residual cancer in the four shaded area on the map. *E* Lesion showing how the reapplication of the fixative limited t the microscopically demonstrated area of cancer Treatment as started in the morning and as completed in the afternoon *F* Healed lesion. There wa no recurrence after t and one-half years.

THERAPEUTIC RESULTS IN CUTANEOUS CANCER WITH COMMENTS

There were 1,5. 4 consecutive cases of histologicall proved carcinoma of the skin in the present series. Included were cancers whicl aried in extent from earl t far advanced An unusuall high proportion were advanced because man patient came from other part of the countr after other forms of therap had proved unsuccessful One-third of the lesions had recurred after previous definitive treatment b means of surger or radiation. None of the patients with purel basal cell carcinoma had me-

tastases but in 12.4 per cent of the patients with squamous cell carcinoma metastases were present. In view of the difference between the prognosis in basal cell carcinoma and that in squamous cell carcinoma the two types are considered separately.

There was a total of 1,071 cases of basal cell carcinoma in which chemosurgical treatment was carried out during the twelve-year period which ended six years prior to this writing. Of this total there were 289 indeterminate cases (patients who died of other causes without cancer or were lost from observation before the end of five years without cancer). This left 782 cases in the determinate group. Of this number there were 768 cases in which treatment was successful (i.e. the patients were free of cancer for five or more years). Thus the five-year rate of cure was 98.2 per cent (768 ÷ 782 × 100).

In the corresponding consecutive series of 483 cases of squamous cell carcinoma of the skin there were 127 indeterminate cases and 356 determinate ones with 302 successful results. Therefore the five-year rate of cure was 84.8 per cent (302 ÷ 356 × 100).

The therapeutic results as expressed in these five-year rates of cure surpass the results in any reported series of similar cases of cutaneous cancer in which treatment was by means of standard surgical and/or radiologic procedures.

The unprecedented reliability was not attained by excessively radical excision. On the contrary, excision was as conservative as the extent of the carcinomas would allow. Usually only 1 or 2 mm. of noncancerous tissue was removed beyond the farthest extension of the cancer at any point. Both the reliability and the conservatism of the chemosurgical method resulted from the complete microscopic control of excision which made it possible not only to remove the main mass but also to selectively remove the silent extensions which were encountered commonly.

A further advantage of the chemosurgical method was the low operative mortality rate of less than ¼ of 1 per cent in a series of 1,554 cases of cutaneous cancer.

CARCINOMA OF THE LIPS.

As in the treatment of cancer of the skin the main mass of a lip cancer is removed surgically prior to the institution of chemosurgical treatment. The latter procedure provides the microscopic control which is responsible for the reliability and the conservatism of the method.

The unprecedented certainty of eradication of the primary lesion is reflected in the five-year rate of cure of 91.7 per cent in a consecutive series of 326 microscopically proved squamous cell carcinomas of the lips. The conservatism which can be safely practiced results in excellent cosmetic results even in cases in which the greater part of the vermilion border is involved (Fig. 83). Since no general anesthetic is required the operative mortality was very low; in the present series the rate was 0.6 per cent and none of the deaths which occurred during treatment were attributable to the treatment itself.

In cases in which regional metastasis was present or suspected, surgical neck dissections were carried out.

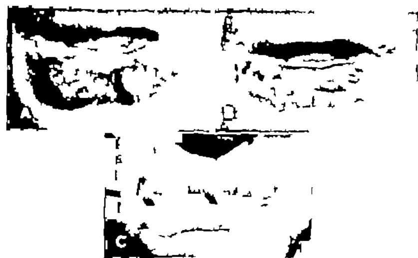


Figure 83.—*A* Squamous cell carcinoma, grade 2 malignancy. Practically all of the lower lip was involved. *B* Granulation tissue after surgical excision of the main mass and after the chemosurgical excisions. *C* Healed lesion. The appearance and function of the lip were excellent. There was no recurrence after five years.

Melanoma

Cutaneous melanoma is amenable to chemosurgical treatment, but preliminary surgical excision of the main mass must be avoided because of the danger of traumatic dissemination of the neoplasm through the blood and lymph vessels. Furthermore, because of the occasional occurrence of satellite deposits of melanoma in the lymphatics at the periphery of these neoplasms, it is necessary to remove an extra zone of tissue after a microscopically melanoma-free level is reached. The width of this zone of safety is in proportion to the degree of likelihood of satellite deposits. This, in turn, is estimated by attention to microscopic manifestations of high malignancy such as pleomorphism, invasion of vessel walls, and hemorrhage into the tumor. These same microscopic features also help to decide whether there is sufficient likelihood of metastasis to justify prophylactic dissection of the unenlarged regional lymph nodes. Enlarged nodes are an indication for radical surgical dissection of the regional node-bearing tissues unless other contraindications are present.

In a consecutive series of 31 cases of cutaneous melanoma, chemosurgical excision resulted in a five-year rate of cure of 38 per cent. The primary lesion was eradicated in 30 of the 31 cases; one patient died of coronary occlusion before treatment had been completed. The maximal degree of conservation consistent with safety resulted in less than the usual deformity (Fig. 84).

Carcinoma of the Penis

In view of the rarity of the spread of carcinoma of the penis by continuous lymphatic permeation, the routine amputation of the penis for this

disease is not justified. The assurance of eradication of the primary lesion by the microscopically controlled chemosurgical method makes it safe to preserve all of the structure except that which is actually invaded by the cancer (Fig. 85). A dissection of the regional nodes is carried out when they are enlarged or when they are suspected of being involved by reason of the large size or the high grade of malignancy of the primary lesion. The five-year rate of cure in a series of 7 cases of carcinoma of the penis was 71.4 per cent.

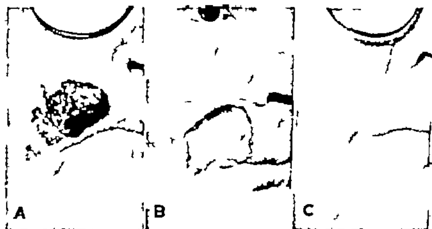


Figure 84.—A. Melanoma which had arisen in the medial half of [illegible] junction nevus and which had recurred after electrodesiccation. B. Granulation tissue after chemosurgical excision of the melanoma and the nevus plus an extra 5 to 10 mm. at the periphery. C. Healed lesion. There was [illegible] recurrence when the patient died of [illegible] accident after seven years.



Figure 85.—A. Squamous cell carcinoma, grade 1, with involvement of the entire glans penis of [illegible] patient twenty-one years of age. The neoplasm had recurred after [illegible] electrosurgical [illegible]sions. B. Granulation tissue after chemosurgical excision. C. Healed lesion. The functions of the organ were unimpaired. There [illegible] no recurrence after six years.

CARCINOMA OF THE VULVA

The microscopic control of excision afforded by the chemosurgical method makes it safe to remove vulvar carcinomas without vulvectomy In advanced cancers which have invaded the vagina the urethra or the perineum, chemosurgical excision affords an even greater chance of eradicating the neoplasm than would vulvectomy because with the microscopic control both the grossly visible and the invisible extensions, may be selectively removed (Fig 86) A dissection of the regional nodes is indicated when there is enlargement or when metastasis is believed likely in view of the large size or high malignancy of the primary lesion.

In a series of 34 consecutive cases of squamous cell carcinoma of the vulva in which chemosurgical treatment was used the five-year rate of cure was 55.8 per cent.



Figure 86.—*A* Squamous cell carcinoma, grade 2 malignancy *B* Granulation tissue after chemosurgical excision. The cancer extended int the all of the vagina and t the anus C Healed lesion. There was no recurrence when the patient died of other causes after tw and one-half years.

COMMENT

In the discussion of the chemosurgical treatment of cancers of the various parts of the surface of the body it was stated that the main reason for the unprecedented reliability and the conservatism of the method was the microscopic control which made possible the selecti e removal of the unpredictable outgrowths from the main neoplastic mass. These silent extensions are more common than realized before the ad ent f chemosurgery

Often the outgrowths form because the cancer has an unusual degree of affinity for certain tissue structures. Many of the more invasive basal cell carcinomas exhibit a tendency to spread peripherally in the dermis and adjacent subcutaneous tissue (Fig 72F) The strands of cancer which intersperse themselves amongst the connective tis ues often are too small in caliber initially to produce isible elevation or a palpable induration In

time of course, the outgrowths in a given area will become both visible and palpable but by that time the microscopically detectable extensions will have spread beyond. Other cancers may show special affinity for fascial planes, periosteum, perichondrium, embryologic fusion planes, nerve sheaths, lymphatic vessels or blood vessels. Some neoplasms on the other hand exhibit no selective affinity for any particular tissue structure. Yet they may extend in an irregular and unpredictable manner as a result of the innumerable variations in the nutritive and mechanical conditions which affect the spread of cancer through the tissues of the host. The important point is that these silent extensions will cause recurrences unless they are sought out and destroyed by a method which provides microscopic visualization during the course of excision. Chemosurgery is such a method.

Another advantage of the chemosurgical method is the low operative mortality. General anesthesia is unnecessary.

The chemosurgical method extends operability to a significant group of patients who ordinarily would be considered inoperable. Fully a third of the patients coming for this modality have been unsuccessfully treated with surgical or radiation therapy. Many of these have extensive cancers. Yet the great majority still are amenable to cure.

A factor of some economic importance is the fact that a great majority of the patients with cancer can be chemosurgically treated in the outpatient clinic. Many of them are able to continue their business with relatively little loss of time.

That the treatment of cancer tissues with chemical fixatives has no tendency to increase the incidence of metastasis has been demonstrated by means of animal experiments. This conclusion has been confirmed by observation of several thousand patients with cancers treated by this method.

The chemosurgical method is not without some disadvantages. For best results a certain amount of training and experience in the operative technique and in the interpretation of the microscopic sections is essential. Moreover, for the preparation of the large, complete frozen sections upon which the microscopic control depends, the services of a specially trained technician are required. Finally, in the treatment of advanced lesions with outgrowths requiring numerous microscopically controlled excisions, the procedure may be time-consuming for the operator and painful for the patient. However, since lesions of this nature often would be fatal otherwise, these disadvantages are relatively inconsequential.

Eventually a well staffed and well equipped chemosurgery clinic should be established in every large center of population.

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Dermabrasion

Charles R. Rein, M.D. and Gustave Sirot, M.D.

Introduction

Kromayer, in 1905, reported on his experiences with the use of cylindrical knives, which were powered by dental motors and applied vertically to the skin to remove lesions of various sizes. He used this method for the treatment of a number of conditions including tattoos, pigmentations, scars, abscesses, nevi and hypertrichosis. He replaced the cylindrical knives with steel burrs and rasps for the extirpation of freckles, lentigines, and other pigmentations. Reiss believes that dental burrs have an advantage over wire brushes and sandpaper. He states that the small size of the burrs permits greater precision and safety in the treatment of tiny areas and that it is easier to control the depth of abrasion. Kromayer experimented with the use of ethyl chloride as an anesthetic and skin hardener but he felt that the pain of the procedure was not significant and therefore the ethyl chloride prolonged the operation needlessly. In 1920 he described an operation for the improvement of smallpox scars, in which the healthy skin between the pocks was abraded down level with the floor of the pit. Of the various anesthetics tried, he found only nerve block anesthesia to be adequate. In 1947 Iverson reported the use of sandpaper abrasion for the removal of traumatic tattoos of the face. The operation was done under general anesthesia and the sandpaper was wrapped around a roll of gauze. In 1948 McEvitt applied the use of sandpaper to the treatment of post-acne scarring with good results. Kurtin in 1953 presented his method of corrective surgical skin planing, employing ethyl chloride as a local anesthetic and skin hardener. The abrasion was performed with motor driven steel brushes. The use of ethyl chloride to provide a rigid, bloodless field for abrasion made this method an office procedure and immediately served to stimulate interest in the field of dermabrasion.

Technique of Dermabrasion

Dermabrasion is a cosmetic procedure; it is an operative procedure; it is a procedure which leaves the patient disfigured for a time; it is a procedure which is frightening to the patient in some respects. For all these reasons, it is vital that the patient have a clear concept of what is being done and what to expect.

Every patient is required to have pre-operative pictures, so that all the pits are clearly recorded for future comparison with the post-operative appearance of the skin. A relative or friend is requested to call for the patient following the procedure. Pre-operative sedation is administered and it is

of utmost importance that arrangements be made for the patient to return home safely. Patients are told to be prepared to suspend their work or other outside activities for a period of ten days, approximately the length of time required for recovery from the procedure. In order to minimize the time lost from work, dermabrasion may be performed late on Friday afternoon. Thus two week ends and the week between are available for recovery and the patient need lose only one week from work or school.

Prior to the dermabrasion treatment, the face is thoroughly cleansed with soap and water, an injection of 50 to 100 mg. of demarol is administered and ice packs are applied to the face for a period of from twenty to thirty minutes. The ice packs used are plastic bags containing a 5 per cent solution of propylene glycol. These are maintained in a semi-solid frozen

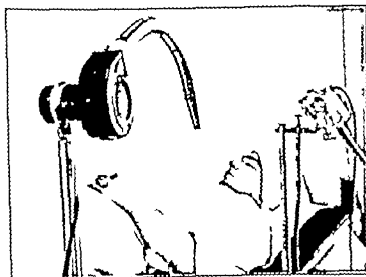


Figure 87.—Pre-operative dermabrasion patient with blower and abrasion dev

state in the freezing compartment of the refrigerator and can be refrozen repeatedly. The cold packs are applied to the face for pre-chilling so that the shock of the ethyl chloride spray will not be too uncomfortable.

Before the procedure commences the patient's scalp and ears are covered with a towel (Fig. 87) and petroleum jelly is applied in a thick layer over the closed eyes to prevent conjunctival irritation by the ethyl chloride spray. A pledget of cotton is placed in the nostril on the side to be abraded to prevent ethyl chloride from entering during the freezing process.

The area to be frozen is bounded by gauze squares and the blower is turned on. The blower (Fig. 88) is mounted on a floor stand and has a flexible nozzle so that the air-flow direction can be turned toward the area to be treated. It is possible to use a hand-held hair drier but this requires an extra hand to be occupied. Furthermore the hand-held set is weaker and less effective in causing rapid evaporation of the ethyl chloride and rapid

freezing of the skin In addition, the hand hair driers tend to warm up after a period of use and soon there is an ineffective blast of warm air being produced After the area to be abraded has been frozen hard all the gauze is removed from the face and the frost is wiped off It is important to remove all the gauze from the operative field because it is quite easy for a piece of gauze to become enmeshed in the rapidly rotating steel wire brush There will be a resultant loud clatter as the gauze is spun around and if the tension on the spring of the handle of the abrading device is sufficiently great, it will snap and the spring will have to be replaced

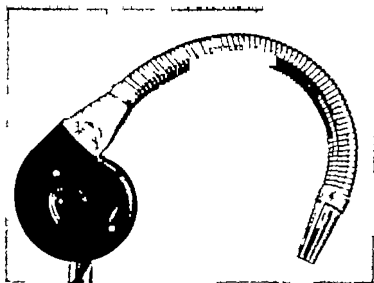


Figure 88 — Blower for dermabrasion.

The abrading device proper is a motor mounted on a floor stand with a flexible shaft attached (Fig 89) At the end of the flexible shaft is a hand piece with provision for inserting and tightening the wire brush mandrel. This device differs but little from a dentist's drill or a jeweler's flexible shaft and either of these devices may be substituted The speed of rotation of the brush is governed by a foot-operated variable rheostat.

The handle is held so that it is parallel with the face and the brush touches the face squarely on edge (Fig 90) It is important to have a firm grip on the handle while the abrasion process is being performed since there is a tendency for the brush to pull toward the right If one is careless or inexperienced it is possible to lose control of the brush and for it to groove the skin beyond the area being abraded A safe position is to hold the handle firmly with the four fingers curled around the right side of the handle thus restraining it, and the thumb on the left side for guidance The brush is then moved in short strokes up and down or with a circular motion until the entire frozen area has been abraded to the required depth As the brush cuts deeper the skin will assume a stringy or fibrous appear

ance and the capillary oozing will become more marked. Individual pits may be abraded with a circular motion to round off their sharp edges and make them less obvious. Active acne cysts, when present, may be opened with the wire brush and as a rule will granulate in satisfactorily. If there is much activity it is preferable to get the acne under control with the usual therapeutic modalities before undertaking dermabrasion.



Figure 80.—Motor and flexible shaft for dermabrasion.

After the initial area has been abraded other areas are similarly frozen and abraded until the entire face has been treated. In the average patient the cheeks and chin are treated. When necessary the forehead or nose can be abraded as well. This should be done at the end of the procedure for these areas are more sensitive and the patient will complain of discomfort when they are frozen.

Post-operative Dressings.

Following the abrasion dry gauze squares are used to [illegible] the entire treated area. These squares are left about fifteen minutes to absorb whatever blood is present. After they are removed only a serous [illegible] is noted. Telfa (Bauer & Black) non-adherent sterile strips are applied t

the abraded skin areas as suggested by Le Van. This product consists of an inert hydrophobic plastic film bonded to a non-woven absorbent cotton fabric. The strips are perforated by pores large enough to pass exudate but small enough to exclude granulation buds. The great advantage of Telfa is its non-adherence. The bandage comes off twenty-four hours after it has been applied cleanly and easily. Even with a petrolatum or antibiotic ointment gauze there is some adherence and difficulty in removing the dressing which has been eliminated by the use of the plastic



Figure 90.—Skin area frozen and brush in position for dermabrasion.



Fig. 91 Fig. 92

Figure 91.—Appearance of skin twenty-four hours post-dermabrasion.

Figure 92.—Appearance of skin four days post-dermabrasion.

strips. Over this, 3 × 3 gauze squares are applied and 5-inch stockinette is drawn over the head to hold the dressing in place. Holes are cut in the stockinette for the eyes and mouth and the stockinette is knotted under the chin and on the crown of the head to prevent it from slipping.

POST-OPERATIVE CARE.

Patients are given full instructions concerning the expected course of events following the procedure. They are advised to remove the dressing at home twenty-four hours after it was applied. The patients are informed about the raw oozing appearance of the skin (Fig. 91) and are told to use sterile gauze squares for absorbing the serous ooze which usually persists





FIG. 93 FIG. 94

Figure 93.—Appearance of face eight days post-dermabrasion.

Figure 94.—Appearance of skin eight days post-dermabrasion following soaking off of residual crust.

for a day or two following the removal of the dressing. Codeine (½ grain) and aspirin (10 grains) may be taken every three hours as needed for relief of the burning sensation which may be present during the first twenty-four to forty-eight hours.

The patient are advised to sleep the first night propped up on two or three pillows. There is a marked tendency for the face to swell for the first two or three days following the procedure and elevation of the head may decrease the swelling.

After three or four days, a firm crust has formed on the patient's face (Fig. 92). As long as this crust persists the patient should not wash the face or to shave. The crust may at times cause a tight itching feeling on the skin. To relieve these symptoms, patient may apply small amount of petroleum jelly. At the end of eight or nine days the crust should be almost completely off (Fig. 93). If this has not taken place on

schedule the patient is advised to apply warm boric acid compresses in order to loosen the crust and cause it to come off within the prescribed time (Fig 94) At this time men may resume shaving Powder or cosmetic creams may be used to conceal the erythema which persists but which gradually fades during the next three to six weeks. The use of vigorous soap and water cleansing as well as the use of drying local applications prescribed for a pre-existing acne condition, should be avoided until the erythema has subsided *otherwise a dermatitis may develop on this sensitive* skin In addition, patients should be warned to avoid sun exposure for a month after the procedure

It is advisable to wait six months between treatments although an interval of six to twelve weeks may be sufficient. With the passage of time the degree of improvement following any dermabrasion treatment increases so that subsequent procedures may be unnecessary

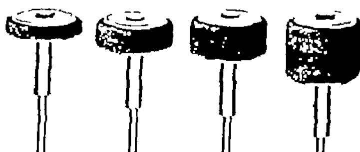


Figure 95 — Various sized stainless steel wire brushes used for dermabrasion.

MODIFICATIONS IN DERMABRASION TECHNIQUES

Many modifications in the procedure have been adopted since its use became widespread Most physicians have found that they prefer to use a narrower brush which allows more precise abrasion of small areas or of individual pits (Fig 95) Another innovation has been the use of fast cutting brushes which permit a deeper and faster abrading process.

There has been improvement in the blowers used to hasten the ethyl chloride freezing of the skin. Le Van advocates the use of a mechanical method of freezing the skin for dermabrasion His apparatus consists of a device which delivers a stream of ethyl chloride and compressed air to the point at which it is aimed A foot pedal releases a compressed air stream which does two things In the first place the air blows out of a nozzle and secondly the air activates a lever which opens the bottle of ethyl chloride (Fig 96) The apparatus requires a tank of compressed air with a two-stage regulator attached The device is effective and enables the operator to *freeze the skin by means of a foot pedal leaving both hands* free This saves the time required to put down the ethyl chloride bottles which are held by hand in the more commonly used freezing methods.

The use of refrigerating agents other than ethyl chloride has been advocated. Foremost among the new refrigerants is dichlortetrafluoroethane (Freon 114) used by Ayres, Luikart and Wilson. Freon is faster freezing than ethyl chloride and does not require a blower. In addition it is noninflammable and does not possess the general anesthetic properties of ethyl chloride. Ayres and his associates carried out freezing experiments with ethyl chloride and Freon 114 on dogs, taking biopsies of the skin for

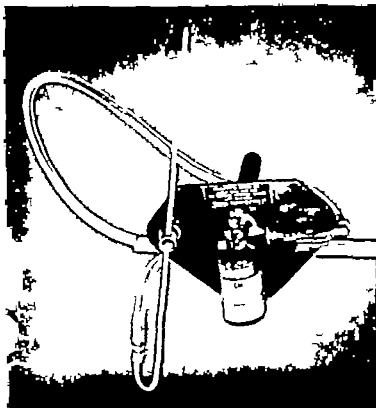


Figure 96.—Le Van mechanical freezing device

microscopic examination at various intervals following the freezing process. They concluded that Freon 114 produced no significant damage when applied for lengths of time comparable to those used in dermabrasion freezing. The biopsy results following freezing with ethyl chloride and Freon 114 showed approximately equal degrees of inflammatory response. When freezing was carried out for more prolonged periods the reaction from Freon was found to be less than from ethyl chloride.

Hulder has suggested the use of 1 per cent gentian violet (methyl-rosaniline chloride N.F.) to define the area to be treated. Th[illegible] is

applied and as the skin is abraded the removal of the dye indicates the border between treated and untreated areas. Also there is an indication as to the depth of the abrasion as one watches the thoroughness of removal of the dye from the abraded surface. Gentian violet may have a mild bactericidal effect on the skin pre-operatively Hul ler also suggests the use of xeroform gauze for the primary dressing and application of layers of antibiotic ointment until the skin is healed after removal of the primary dressing

Grais and Rogin suggested the use of a rubber mouthpiece to prevent inhalation by the patient of ethyl chloride fumes during the procedure *They employ the rubber mouthpiece used in a BMR machine to which is* attached a piece of polyethylene tubing of large diameter Grais also uses a rubber dam sealed on with adhesive tape as protection for the eyes.

INDICATIONS AND RESULTS

Gross and Wright believe that superficial scarring of recent duration may be more amenable to abrasion than that of long duration Dobes believes that deep-pitted scars can be improved by abrasion with a wire brush and that this method should be more practical and safer than sandpaper There is general agreement however that varying degrees of improvement up to 80 per cent or more can be anticipated after two to three dermabrasion procedures in the majority of carefully selected patients with acne scars.

Though the overwhelming majority of dermabrasion procedures are done for the improvement of acne scars the method is employed for a variety of other conditions. The results of dermabrasion for freckles and wrinkles are excellent Since the pigment of the freckle is superficial one dermabrasion treatment is usually sufficient The procedure can be done superficially and as the brush passes over the freckled skin the freckles are literally wiped away This can be used for the treatment of freckles on the chest and back as well as on the face with good results and rapid healing

The treatment of wrinkles also brings satisfactory results Extreme care must be exercised to avoid accidental injury to the eye It is wise to hold a finger directly over the eyelid edge while freezing and abrading to prevent injury from the ethyl chloride or from the rotating brush Mineral oil instilled in the conjunctival sac is an added precaution against ethyl chloride injury With care and experience this procedure can be performed safely

Crupper has employed dermal rasion in 3 patients with lupus erythematosus scars and reported excellent cosmetic results. Our experience has been limited to 1 patient Although the improvement of the scars was satisfactory the patient developed an exacerbation of chronic discoid lupus erythematosus in all the abraded areas several weeks following the procedure

Although marked improvement of tattoos keloids port wine marks and Darier's disease has been reported the results of our limited experience with these conditions have not been acceptable The pigment of tattoos usually extend deep into the cutis and one must abrade very deeply in order to eradicate all the pigment Then too usually tattoos are removed from the upper extremities or chest where healing following abrasion i

delayed and leaves a scar rather than the normal appearing skin one sees on the face after abrasion The scar however is usually soft, pliable and cosmetically acceptable although hypertrophic scarring of the abraded area may occur

This procedure has been applied with good results to the treatment of flat brown pigmented moles.

UNTOWARD REACTIONS

As a procedure becomes more widely used information accumulates as to the possible undesirable side effects and sequelae

1 *Pyoderma* —Some patients may develop varying degrees of impetigo and pyoderma from three to fourteen days after dermabrasion

This complication has occurred with surprising rarity and responds promptly to antibiotic therapy

2 *Milia* —The development of milia several weeks after dermabrasion is a frequent occurrence Although they usually disappear without interference it is preferable to surgically express them in order to hasten involution

3 *Prolonged Post-operative Erythema* —All patients subjected to dermabrasion will present varying degrees of erythema which will usually disappear in three to six weeks. In some instances, however the erythema may persist for several months. Edelstein in a series of 40 dermabrasions, encountered 4 cases of erythema which persisted for two to three months. He suggests four possible explanations for this type of reaction

(a) Excessive refrigeration
(b) Overexposure to sunlight prior to complete healing
(c) Overzealous and premature cleansing of the face with soap or a defatting agent
(d) Premature resumption of topical acne treatment

4 *Hyperpigmentation* —Hyperpigmentation of two varieties is occasionally seen in patients following dermabrasion.

(a) Hyperpigmentation at the edges of the abraded area similar to that observed at the periphery of a [illegible]tiliginous patch
(b) A less common variety of pigmentation is a mottling of the abraded area itself Usually the differences in pigmentation within this area are small but noticeable This type of pigmentation may follow an uneven abrasion procedure

Both types of hyperpigmentation will fade graduall and spontaneousl An ointment containing a 5 per cent concentration of th monobenzyl ether of hydroquinone (Benoquin Elder) ma be used t accelerate fading of the pigmentation.

5 *Hypertrophic Sca* —Hypertrophic scarring following dermabrasion is the rarest but b far th most serious complication of the treatment and several instances ha been brought to ur attention Too deep an abrasion or abnormal persistence of the post-operati crust may be etiologicall significant

6 *Eczematous Reactions* Mild eczematous reaction consisting mainl of erythema, scaling and occasionall ery mild oozing and crusting re sometimes seen. W agree with Edelstein that these eruption are very

resistant to therapy Gradual spontaneous disappearance of the inflammatory and eczematous process occurs.

Selection of Cases

Careful selection of cases suitable for dermabrasion is a most important prerequisite for good results in employing this procedure The psychological state of the patient is probably the most important single factor to be considered in determining whether or not a patient should be abraded Those who feel that all their problems are due to their acne pits are definitely not good candidates for this procedure

Certain types of scars do not fare well with dermabrasion The flat wide and confluent scars causing an undulating appearance of the skin surface are improved comparatively less than other scarring types. Similarly the punched out deep sharp-edged scars of the "ice-pick" variety do not respond as readily as the more superficial ones.

Patients with very superficial and minimal scarring should not be encouraged to have the procedure done since they may not be satisfied with anything less than almost total obliteration of the scars a result which is often not possible to obtain.

Summary

In summary dermabrasion is the treatment of choice for acne scarring Good results can be anticipated and are obtained in properly selected cases. The procedure must be thoroughly discussed with the patient before operation and at every stage of the treatment Careful selection of patients is of great importance Best results can be expected following one to three adequate abrasion treatments.

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Cryosurgery

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The two agents used most often in cryosurgery are solid carbon dioxide and liquid nitrogen. The temperature of the former is −78.5° C. and of the latter is −195.8° C.

Within a few minutes after application of either, Lewis's triple response with reddening, wheal formation and surrounding flare occurs. Over a period of an hour or more this recedes. If freezing has been sufficiently intense, however, the reaction again increases and blistering develops within the next few hours. After two or three days the fluid begins to absorb and the blister to flatten. After five or six days only a drying crust remains. If undisturbed this exfoliates spontaneously in from ten days to three weeks. This varies with the intensity of application and the location and character of the skin. Thicker skin responds more slowly and a longer period is required for the reaction to subside and exfoliation to occur. The response to liquid nitrogen is more intense than that caused by a comparable treatment with solid carbon dioxide.

A biopsy specimen removed thirty hours after freezing normal abdominal skin with liquid nitrogen, with light pressure for forty-five seconds, showed a vesicle which had raised the epidermis cleanly from the dermis at the dermo-epidermal junction. The dermis was edematous, especially in its upper portion, and showed slight basophilic degeneration. There was a mild infiltrate of inflammatory cells scattered throughout the dermis. The majority of the cells were polymorphonuclears, but some round cells were also present. A section of a similar specimen taken eight days after freezing showed the degenerated remains of the old epidermis which constituted the roof of the vesicle. A newly regenerated epidermis, two or three or more cells thick, was already present. Edema and cellular infiltrate were less pronounced than in the thirty-hour specimen.

Freezing produces stinging pain which is more marked with liquid nitrogen than with solid carbon dioxide. Once the skin is fully frozen, this discomfort decreases. During thawing, burning and aching pain returns and lasts for several minutes. Some discomfort then persists for several hours following which the lesion is tender only on pressure.

The reaction described above is followed by healing without appreciable scarring, although some mild relative depigmentation may remain. Freezing for a longer period and with greater pressure increases the depth of the reaction. Repeated intense freezings may result in noticeable atrophy and depigmentation. In general, cryosurgery is best reserved for the removal of lesions which are relatively superficial.

SOLID CARBON DIOXIDE

AVAILABILITY

If one has only an occasional patient on whom solid carbon dioxide is to be used a piece can be secured at a local soda fountain or creamery If kept in several layers of wrapping paper or newspaper it will last for several hours. Its cost when used occasionally is negligible. It entails the nuisance of correlating the patient's visit and obtaining the "dry ice If one wishes to have it on hand for use at all times it may be obtained in most areas in the form of a compressed gas in a closed cylinder which can be kept indefinitely in the office The carbon dioxide gas can be released from the cylinder and collected in a solid state by one of several methods.

COLLECTION AND USE OF SOLID CARBON DIOXIDE.

The cylinder should be held upside down with the release valve lower than the body of the cylinder If a large cylinder is used and it is inconvenient for it to be placed in an upside-down position a siphon arrangement can be fitted which will permit the cylinder to remain upright The gas is then released into a small pocket" of porous material. A piece of chamois skin formed into a small pouch and tied snugly about the release spout is adequate We find it convenient to cut the fingers out of ordinary canvas gloves. These are inverted so that the soft "flannel side is out. The fingers are tied like nipples over the spout with cord or a short length of 1-inch gauze bandage Depending on which finger of the glove is used and how 'long or short it is tied over the spout varying sizes of pieces of solid carbon dioxide are obtained There are special apparatuses available commercially for collecting the solid carbon dioxide and for moulding it into different sized pieces. We have not felt the need for such equipment

As the gas is released under moderate pressure into the glove finger or chamois, it cools and solidifies and forms a firm mass. This mass must then be adapted to the size and shape of the area to be treated When this is of moderate size and of fairly regular outline it is relatively easy to shave or melt" the carbon dioxide to a proper form. A knife or scalpel can be used to carve it or it can be pressed against a firm flat surface Rolling or pressing it against the hot top of a sterilizer is easy and convenient. Once it has been shaped properly it can be applied directly

Another method is to form a shield to protect the normal surrounding skin Lightweight pliable cardboard or even heavy blotting paper will provide sufficient insulation for the time that the solid carbon dioxide is applied Such a shield with a central hole the size and shape of the lesion to be treated can be held or anchored in place with adhesive while a piece of solid carbon dioxide somewhat larger than the area is pressed over it

If the field is too large or irregular to be treated in one application it can be marked off in sections and these treated separately

INDICATIONS AND ADVANTAGES OF SOLID CARBON DIOXIDE

We usually reserve the use of solid carbon dioxide for [illegible] such as hemangioma where we wish to compress the lesion and distribute the reaction as evenly as possible throughout its whole thickness. We believ

that solid carbon dioxide applied with pressure achieves this depth effect with less intense superficial reaction than is produced by the colder liquid nitrogen

In treating hemangiomas an attempt is made to produce thrombosis and gradual involution of the lesion without frank ulceration. Those which are soft and purplish in color and which appear to have very little connective tissue stroma are prone to ulcerate spontaneously or following slight trauma These are frozen with very little pressure and for only a few seconds. Others, especially the deeper ones and many of those on the scalp will require firm pressure and perhaps as long as fifteen to twenty seconds to produce a satisfactory response. Likewise those which are being treated a second or third time and in which some involution has occurred already will tolerate more intensive treatment

The reaction dries to form a crust which exfoliates within two or three weeks after which the degree of improvement can be determined If there has been appreciable involution additional treatment may be delayed to see how far it may progress. Once started improvement may continue satisfactorily to complete involution, and occasionally a single treatment only is given. We usually do not re-treat more often than once a month or until the reaction from the previous application has cleared completely The total number of treatments may average three or four The end result is usually a soft, pliable atrophic area somewhat paler than normal surrounding skin. This change is seen also in lesions which have involuted spontaneously

Deep and extensive cavernous hemangiomas may respond best to other treatment methods, or perhaps to a combination of freezing and the injection of a sclerosing solution.

Nevus flammeus or port-wine hemangiomas are resistant to treatment. Solid carbon dioxide has the major advantages of wide availability and ease of storage

Carbon Dioxide Slush.

Where solid carbon dioxide is available but liquid nitrogen not a substitute for the latter may be prepared by placing solid carbon dioxide in a container and adding acetone with stirring until a slush of the desired consistency is obtained This should be comparable to a sherbet This is applied with a cotton tipped applicator to the lesion to be treated as is done with liquid nitrogen. It is slower to produce freezing than liquid nitrogen but is more rapid and more adaptable to irregular areas than is solid carbon dioxide

LIQUID NITROGEN

Availability

In a clinic associated with an institution having a well equipped physics department it may be possible to obtain the liquid from this source Thus the liquid nitrogen used in the dermatology clinic of the Student Health Service at the University of California is obtained from the Physics Department each clinic morning

In most instances it will be necessary to obtain the liquid nitrogen from one of the companies distributing industrial gases commercially. Since it is not readily shipped in small quantities, its use is necessarily restricted to centers where these gases are supplied for industrial use.

Figure 97. *A*, Transfer of liquid nitrogen from storage container by siphon to portable thermos bottle. *B*, Making solid [illegible] dioxide [illegible] from [illegible] of gas using finger cut from ordinary canvas glo[illegible]. *C*, Solid piece of [illegible] dioxide formed in glove finger in (*B*). *D*, Applying liquid nitrogen [illegible] cotton [illegible] to [illegible] lesion of verruca plana. *E-a*, Plant[illegible] wart before and *E-a'* immediately after [illegible] with liquid nitrogen. *E-b*, [illegible] dried blister one [illegible] after freezing [illegible] small group of [illegible] and *E-b'* the same area immediately after removal of the blister [illegible] (The irregular [illegible] which remains is frequently seen at this time even though the [illegible] has been treated adequately.) *E-c*, [illegible] one week after removing [illegible] blister and *E-c'* the same area [illegible] week later completely healed. *F*, [illegible] blister [illegible] plantar wart one week following liquid nitrogen freezing. [illegible] Removal of [illegible] large and approximately eight [illegible] plantar [illegible] weeks after liquid nitrogen freezing. *H*, Removal of single plantar wart [illegible] liquid nitrogen freezing. *I*, Senile keratosis on rim of ear before (*a*) and [illegible] month [illegible] after freezing with liquid nitrogen.

If one wishes to use liquid nitrogen only occasionally an ordinary quart thermos bottle may be taken to the source of supply and filled there If not agitated too much or used too freely it will last for a full day and may be used to treat many patients. If it is to be kept on hand continuously without the need of frequent trips to the plant which supplies it, then a special container is needed These can be bought in sizes holding 3 liters or more

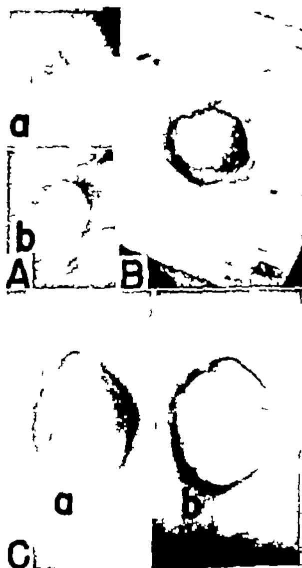


Figure 98 [illegible] before (a) and immediately after (b) freezing with liquid nitrogen B, Shielding of an hem[illegible] with heavy blotting paper preparatory to freezing with solid carbon dioxide C Hemangioma before (a) and immediately aft[er] (b) freezing with solid carbon dioxide

These containers usually have long tube-like necks and small openings and the liquid is not easily accessible in them. They are used as storage containers and the liquid is poured or siphoned from them into smaller vessels for actual use in the office. We use a pint thermos bottle. Its top is covered by a square of orthopedic felt and it is surrounded by cotton waste and enclosed in a small plywood box. This is provided with a handle for ease in transportation.

The low temperature of the liquid nitrogen causes rapid condensation of atmospheric moisture. This may cause ice to collect slowly about the opening of the thermos bottle and it may float on top of the liquid nitrogen. When all the liquid has evaporated, the ice will thaw and collect in the bottom of the thermos as water. Such icing is minimized by the small size of the opening in commercial containers made expressly for transportation and storage of these gases. The container should be emptied and dried before it is refilled.

Application of Liquid Nitrogen

Liquid nitrogen is applied by means of an ordinary cotton swab or applicator stick. The cotton absorbs and holds it better if not wrapped too tightly. The swab is dipped into the liquid and then transferred directly to the part to be treated. If several areas are being treated, ice may collect on the cotton so that several applicators should be available.

In treating lesions whose margins are not always abrupt and clearly evident it is helpful to first outline the area to be treated with ordinary pen and ink. Freezing may otherwise obscure the boundaries and one may finish the treatment somewhat "off target."

No appreciable pressure is required in treating most superficial conditions. Freezing is almost instantaneous. Lesions of considerable depth, such as warts on the palmar or plantar surfaces, require several seconds to become frozen throughout. Pressure with the applicator stick results in more rapid and deeper freezing. Hyperkeratosis delays freezing since cornified epidermis acts as a good insulator.

In applying liquid nitrogen to a small lesion, it is necessary to interrupt contact between the applicator and skin frequently. If this is not done freezing proceeds rapidly to a greater depth and width than is needed. Thus the treatment consists of touching the growth intermittently, often enough and long enough to keep it frozen for as long a period of time as required to obtain a therapeutic result. If there are two or three small areas in close proximity, these can be treated concurrently by alternately transferring the applicator saturated with the liquid nitrogen from one to the other. *The desired depth and width of freezing can be determined* by inspection since the area actually frozen is white and easily visible. The ideal reaction is one in which a blister is produced in a narrow zone about and beneath the lesion. This separates it from the surrounding normal tissue.

The time required for adequate treatment varies with the thickness, size and character of the lesion. The time is measured as the period during which the liquid nitrogen is actually being applied. It usually takes as long and sometimes longer for thawing to occur after the application has

been discontinued In treating hemangiomas a period of ten seconds or less may be adequate and longer freezing may predispose to ulceration. However in most lesions a period of from thirty to ninety seconds will be used For small superficial growths on thin delicate skin such as that on the face and the dorsum of the fingers and hands and of the skin of children, fifteen to thirty seconds may suffice Juvenile plane warts and early keratoses may be treated in this manner Common warts on the back of the hands may require a treatment of sixty seconds. For most lesions on the palmar and plantar surfaces, from ninety to one hundred-twenty seconds is necessary If the lesion is heavily cornified or deeply imbedded two to three minutes may be required

FOLLOW UP CARE.

The patient may return in twenty four to forty-eight hours after treatment to see if satisfactory reaction has developed If it has not a second treatment may be given at that time. Usually however it is not necessary to see the patient again until healing is complete

We do not usually open and drain the blisters or remove their roofs. The blister top is left in place This makes the after-care simpler since secondary infection rarely occurs and dressings are not required It is usually possible to tell whether or not treatment has been successful as soon as the dried crust has separated If a wart has not completely disappeared it will be smaller shallower and devoid of horny covering Re-treatment at this time is more likely to complete the removal than if it is delayed

In an occasional case the blister continues to spread beyond the area frozen. Apparently pressure of the vesical fluid causes this enlargement This occurs most commonly over joints or pressure points. When it happens, the vesicle may be cleansed and opened with a sterile needle or the top may be removed and a sterile dressing applied It is advisable in some cases especially in treating plantar warts to remove the blister top shortly after it forms. This will not only prevent undue enlargement but may also lessen the discomfort of a tense thick walled blister

Hemorrhage may occur into the blister This causes it to become purple or black in color This is not important but it may cause the patient concern if he is not told that it may happen.

INDICATIONS FOR AND ADVANTAGES OF THE USE OF LIQUID NITROGEN

Liquid nitrogen has been of greatest value in the treatment of warts and keratoses

Juvenile plane warts respond nicely When several dozens or scores of them are present however it is impractical to treat each one individually It may be helpful then to brush the liquid nitrogen slowly over the involved area. A larger applicator made by wrapping more cotton about a heavier stick (a piece of small doweling) is used With proper pressure the warts being slightly elevated will freeze more quickly and thoroughly than the normal skin An erythema is produced over the whole treatment field but it is sometimes possible to cause the warts to exfoliate without blistering the normal skin.

Liquid nitrogen is the treatment of choice, we believe, for most common warts. The majority of them respond to a single treatment. The percentage of success decreases with warts involving the palmar skin. Those which occur about the nails frequently are deeply embedded and are stubborn and resistant to treatment. A follow-up study in the dermatology clinic of the Student Health Service at the University of California in Berkeley showed a cure rate in all types of common warts, treated with liquid nitrogen, of approximately 63 per cent. Of these, about 24 per cent required more than one treatment.

We are using liquid nitrogen more and more in the treatment of plantar warts. After-pain, however, may be severe. As previously mentioned, drainage or early removal of the blister tops is frequently desirable in such cases. If it appears that some warty tissue has failed to be exfoliated with the overlying skin and is still present on the "floor" of the blister, application of bichloracetic acid or 25 per cent podophyllin in acetone at this time may complete the treatment.

Warts of the mucous membrane surfaces respond satisfactorily to freezing. Those involving the male beard are frequently tiny and numerous. While they may be treated with liquid nitrogen, it is quicker to use a fine electrodesiccating spark.

Warts will continue to be at times a stubborn and embarrassing treatment problem until someone develops a specific agent for destroying the causative virus or a uniformly efficient vaccine. The failure rate with the use of liquid nitrogen is higher than one would wish, but in comparison with other treatment methods it still has many advantages.

Seborrheic keratoses may be thick and elevated but they do not extend deeply into the skin. This makes them ideal subjects for treatment with liquid nitrogen. Treatment time is usually from forty-five to ninety seconds. One must be sure the whole thickness of the keratosis, including its base, is frozen. One should be alert to exclude pigmented basal cell epitheliomas, pigmented papillary nevi and melanoma, which may on rare occasions resemble seborrheic keratoses.

Superficial senile or actinic keratoses respond readily to treatment with liquid nitrogen. Again, from forty-five to ninety seconds of freezing is usually used. Many disappear without trace or at most leave behind only mild relative depigmentation. For senile keratoses which show appreciable infiltration, and for frank epitheliomas, other methods are preferable.

Superficial leukoplakia may be satisfactorily treated with liquid nitrogen. If the lesion is in the oral cavity, the patient should be instructed to hold his breath, since the intense cold fogs the moist atmosphere and obscures vision.

Keloids, particularly if small, may be improved by freezing with liquid nitrogen, and the lesions of folliculitis cheloidalis have been helped greatly by freezing.

In general, more recent hypertrophic scars or keloids respond better than older lesions. Repeated intense freezing is required with the older lesions and response is slow.

Pitted scarring of the type that follows acne vulgaris may be treated with liquid nitrogen. If the scars are isolated, the margins may be frozen indi-

vidually When the process is extensive the brushing technique described f r treatment of juvenile plane warts may be used. This result in a diffuse reaction with marked erythema and perhaps superficial vesiculation and is followed by peeling Progress is slow and many treatments may be needed These considerations limit the usefulness of this procedure

Pyogenic granuloma molluscum contagiosum superficial capillary vascular nevus, senile ectasia and nevus araneus all respond to treatment with liquid nitrogen. In many instances however other method of therapy for these conditions may be equally advantageous or even preferable

In summary liquid nitrogen is easily applied to areas of uneven surface and irregular outline Multiple lesions are easily and rapidly treated Pain is appreciable but is usually tolerated without anesthesia Reaction tend to heal more rapidly than those produced by other methods of surgical destruction After-care is simple and complications are infrequent Scarring is minimal and thus far no keloid has been observed following its use

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Therapeutic Tattooing

Ervin Epstein, M.D.

Like certain other cosmetic procedures or products tattooing may have therapeutic value This was recognized as early as 1835 when Pauli employed it in the treatment of congenital purple plaques and other lesions of the skin More recently Byars and Conway used this procedure to produce a matching color in skin grafts. Conway has employed it to eradicate port wine marks (nevus flammeus) Turell has recommended it for the treatment of intractable pruritus ani Shie suggested tattooing to camouflage unsightly tattoos on the skin. Grinspan and his co-workers recommended tattooing with gold for vitiligo While this technique is not widely used for any of the aforementioned conditions, the promise of this modality dictates its inclusion in this book.

Apparatus.

Each author has a different apparatus for tattooing Probably all are satisfactory Byars suggested a row of needles soldered on to a metal bar This can be used to prick manually the selected pigment into the skin. This, of course is a slow tedious process. Conway Turell and Schmidt independently suggested the use of a vibrating tool This is inexpensive equipment The Vibro-Tool manufactured by the Burgess Battery Company of Lake Zurich Illinois is a satisfactory example of this type of tattooing machine According to Schmidt a tube tipped leather punch (attachment V 82) which is $\frac{1}{16}$ of an inch in diameter is used as a needle holder One or a group or a row of small sharp steel sewing needles is soldered into this It is important that the points extend to a uniform level. The needle holder is held in the chuck of the reciprocating hammer rod The needle guide is made by brazing or soldering the tip of an old Leur-lock syringe to the end of a foot gage (attachment V 101) The needle flange collar and glass tip is removed from the Leur-lock nickled brass tip The needle guide is slipped over the needle cluster and the fork is snapped into place on the adjustable expansion collar The latter held in place by a set screw determines the level of the needle guide and controls the depth of penetration of the needles into the skin The needles in their holder and the needle guide are sterilized The switch is turned on to see if the needles project the proper distance beyond the tip.

Flexible shaft machines have been devised. A dental drill or skin planing machine may be used if the speed is reduced to 3,000 revolutions per minute A tattooing attachment may be purchased for the latter apparatus. Conway recommended a similar instrument with the added







Figure 09. T ttooi g I strument. A Con dermojector pparatus (courtesy Robb ns Instrument Co. New York). Flexible shaft machine ith foot rheostat switch. Th t ttoo handpiec oscillates t 1300 times per minut. Pigment must be painted on kin. B Burgess tool converted t t ttooer (courtesy of Dr Ot I I Schmelt re pri ted b permission from A M A A h Dermat A gust 19 1).

advantage of a pigment cup that slowly feeds the pigment paste into the hollow shaft of the needle holder

Professional tattooers engaged in cosmetic tattooing—if this term can be used—often construct their own machines of brass tubing and needle rods attached to the clapper arm of a small doorbell type electromagnet operated through a transformer

PIGMENTS.

The basic purpose of therapeutic tattooing is to inject pigments into the dermis. These, when viewed through the overlying epidermis, must resemble the normal color of the patient's skin. To accomplish this, requires certain artistic skill. This match is *obtained by the mixing* of colors such as one would employ in producing an oil painting

The following basic pigments are recommended by Conway

White	Titanium or zinc oxide, U.S.P
Yellow	Oxide of iron
Red	Mercuric sulfide (cinnabar)
Red (flesh color)	Ferric oxide
Blue	Cobalt blue
Black	Black oxide of iron
Green	Hydrated chrome oxide

In addition, he also recommends ochre, sienna and other earthy metallic oxides.

All of these pigments are insoluble and may be sterilized in 70 per cent alcohol or by autoclaving

TECHNIQUE OF TREATMENT

Conway recommends the following procedure. The area to be treated is prepared by washing with soap and water painted with aqueous solution of merthiolate and draped with sterile towels. The technician wears sterile gloves and uses sterile pigments and instruments. The procedure should be withheld in the presence of infection. The pigments are mixed into a thick paste with sterile water This may be inserted in the pigment cup or it may be rubbed on the skin or the needles may be dipped into the paste. The current causes rapid oscillation of the needle or needles. The needles are inserted into the skin at an angle of approximately 00 degrees so that the needles deposit the pigment in an oblique plane at varying depths in the dermis. It is important that the color be inserted in the upper portion of the corium It must be superficial to mask underlying pathology The pigment deposited in the epidermis is desquamated while that deep in the dermis is absorbed by the circulation. Bleeding and exudation of serum is controlled by sponging.

At the first sitting a small area is treated to judge the matching of the colors with the normal skin. A crust forms over the treated area and is sloughed off during the following six to ten days.

It is necessary to wait three to four weeks to judge the effect of treatment Despite careful tattooing some of the pigment is deposited in the epidermis and is lost with the desquamation. Some of the pigment is inoculated into

the area of capillary dilatation and is absorbed. Once the proper combination of pigments is established, treatments may be given at two week intervals until the entire lesion has been injected.

A skilled technician can treat 2 to 6 square inches in one hour depending on the skill of the operator and the cooperation of the patient. The injection causes some discomfort, but the average individual tolerates it without anesthesia. General anesthesia is necessary in children. One per cent procaine hydrochloride can be mixed with the pigments in apprehensive or hypersensitive patients.

The above technique is applicable to treating port wine marks or coloring skin grafts. However, modifications are necessary in other conditions.

For the removal of tattoos Shie uses *tannic acid and silver nitrate*. After a surgical preparation, 50 per cent tannic acid in water is tattooed into the design. Care must be exercised that the solution is carried well into the dermis. The tannic acid is applied to the skin and is kept damp by the frequent addition of fresh solution. The skin should be held on a stretch. After the tattooing is completed, the surrounding normal skin is protected with petrolatum and a silver nitrate stick is rubbed into the area. The operative field is washed with cold water and the petrolatum is removed. A wet dressing of tannic acid is applied to assure absorption of the silver nitrate into the corium. In this location it combines with the tannic acid to form silver tannate. This compound masks the previous tattoo.

Turell recommends the use of mercury sulfide for pruritus ani. This is performed only after the failure of conventional dermatologic and proctologic treatment. It is not done in the presence of infection or ulceration. A patch test of [illegible] per cent ammoniated mercury ointment is used before this procedure in an attempt to rule out mercury sensitivity. A regional relaxing anesthetic that will last for one hour is used. *After a surgical preparation of the skin*, a thin layer of petrolatum is applied. The skin is held taut to remove the cutaneous folds. The needles are slowly inserted through a film of mercury sulfide paste at an angle of 45 degrees. The paste is a mixture of the mercury sulfide powder and sterile distilled water. The tattooing is continued until the involved area shows a uniform permanent red discoloration. It is important not to miss any areas because incomplete tattooing will lead to persistence of the itching according to Turell. Following the operation, petrolatum gauze is applied. Desquamation occurs within a few days and re-epithelization ensues within a few weeks. Wet dressings (such as liquor aluminum acetate) and sedatives are used to minimize post-operative discomfort, edema and weeping.

Dangers of Tattooing

This subject was investigated in collaboration with Lubeck. Beerman and Lane have published a thorough review of this subject. The main danger of tattooing *in general is concerned with infection*. Eighty per cent of the reported complications have been of this type. Of course this occurs mainly in so-called "tattoo parlors" where strict surgical asepsis is seldom observed. These infections include not only those due to pyogenic organism but also syphilis, tuberculosis, leprosy, etc. This can be minimized by *surgical preparation* as recommended by Conway, Shie, Turell and others.

Even in the treatment of pruritus ani Turell does not mention infection as a complication.

Sensitivity to dyes may occur. This is particularly true with red dyes which are usually mercurials, especially cinnabar. A patch test with 2 per cent ammoniated mercury ointment can not rule out the possibility of mercury sensitivity for several reasons. In the first place the sensitivity may not develop until after the tattooing. Even old tattoos may become inflamed in patients developing such a sensitivity. Secondly, in a patch test the mercury is applied to the surface rather than deep in the corium as deposited by tattooing techniques. Third, this mercury is in a different chemical combination and the sensitivity can be to specific linkages rather than to mercury in general. The same may be said about the use of pigments not containing mercury, although sensitization to such dyes is less common. It should be remembered that sensitivity to mercurials is not rare and may be associated with systemic toxicity including stomatitis, nephritis, etc. The dermatitis may become generalized. The eruption may remain unchanged or may disappear or may become more marked with the passage of time. Of course, if a sensitivity dermatitis develops in the tattooed area, the offending chemical can be removed by surgical excision.

Tattooing may precipitate a malignancy. According to Beerman and Lane, a melanoma developed in 1 case reported by Sharlit and a reticulohistiosarcoma resulted in 1 instance mentioned by Auger. Obviously one should not tattoo over a junction nevus. The importance of trauma in sarcomas and epitheliomas is a subject of debate. Considering the numbers of people who have been tattooed, the incidence of malignancy of the skin following this procedure is very low indeed.

Tattoos often act as a loci of locus minoris resistentiae. In other words, other cutaneous conditions may localize in tattooed areas. This is particularly true of mercury dyes. For instance, lupus erythematosus will often involve the red dye of a cosmetic tattoo. The lesions of sarcoidosis, psoriasis and lichen planus commonly localize in tattoos (Koebner's phenomenon).

Conway listed the following complications. In 1,344 treatments he noted 1 case of cellulitis and 1 instance in which a pustular dermatitis developed. A mild glazed appearance of the skin was the end result in 20 cases. Thickening of the skin was noted in 10. In 4 patients, one or more small elevated hemangiomas developed in the treated field. Presumably this was due to trauma from the needles. This was managed successfully by excision of these small areas.

In summary, these potential dangers are insufficient to condemn this method of treatment or to withhold its use in indicated cases.

RESULTS

These procedures have been performed by so few people that it is difficult to evaluate the results of therapeutic tattooing. The originator or main advocate of any procedure secures better results as a rule than those who follow him. However, the reported results of these experts are given as a suggestion of what one can expect from tattooing.

Turell's statistics are difficult to evaluate However in 93 patients with pruritus ani 55 (59.3 per cent) had "good" results 21 (22.5 per cent) had "satisfactory" relief and 17 (18.2 per cent) were "poor" Therefore on a percentage basis, the results probably are no better than that obtained by



Figure 100 Before and after photographs showing the result of treatment of vitiligo by the tattooing of 20 per cent aurothioglucose in sesame oil into the skin (Courtesy of Dr Da l C nepun, Buenos Aires Argentina.)

many other methods including x-rays and psychotherapy With this in mind the tattooing of mercury sulfide is recommended only in patients resistant to other less drastic measures.

Shie offered no statistical proof of the efficacy of the removal of cosmetic tattoos by therapeutic tattooing The cases illustrated in his

article show striking improvement but hardly convince one that this method is uniformly successful

Conway presented more detailed results in the camouflaging of nevus flammeus. Of 203 patients selected as being suitable for treatment only 102 completed the treatments. At the time of his report 41 were still under treatment. These patients received an average of 7 treatments each The number of treatments varied from 2 to 27 in individual cases. This varied with the size of the lesion In 159 (83 per cent) of the 192 completed patients the results were satisfactory to the surgeon and to the patient. Thirty-three (17 per cent) of the patients expressed dissatisfaction with the results of the treatment

Statistics are not offered by either Conway or Byars regarding the use of tattooing for skin grafts

Grinspan Calandra and Fairman in Buenos Aires have used tattooing in the treatment of vitiligo. However instead of using pigments as the others did they tattooed the achromic area with a gold salt (20 per cent aurothioglucose in sesame oil) The technique of tattooing is similar to that used with pigments for other conditions. The treatments are repeated weekly These workers have treated 105 patients with vitiligo. However only 58 had more than 20 treatments or cleared in fewer than this number Since improvement usually starts between the fifteenth and the twentieth treatments, those having had less than 20 were not included in the series. Of the adequately treated group 10 (17.2 per cent) were considered failures 9 (15.5 per cent) showed some improvement and another 39 (67.2 per cent) were cured These results must be considered excellent in a disease as resistant as vitiligo There were 5 recurrences (2 after exposure to the sun after the development of hepatic conditions and 1 during pregnancy) It should be noted that this is a method of introducing a medication into the dermis not a way of camouflaging The treatment of pruritus ani belongs in this same class

It is difficult to judge the results of tattooing since "satisfaction and dissatisfaction" varies tremendously with both the patient and the operator There is no question but that therapeutic tattooing offers promise in the camouflaging of discolorations of the skin as well as the restoring of pigment in achromic or lighter areas. However insufficient data are available to allow for an accurate statement regarding the potential value of this modality

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Surgery of the Nails

Ervin Epstein, M.D.

The surgical treatment of disorders of the fingernails and toenails is a special field within itself. In treating these structures recourse may be made to cold steel surgery or to hot cautery approaches or to electrodesiccation and curettage or to special techniques of grinding.

Medical treatment of the nails is difficult, long and comparatively unsuccessful. Mycotic infections do not respond well to fungicides because these agents do not penetrate deeply into the nail. Those that do, such as ammoniacal silver nitrate, are not powerful parasiticides. Systemic treatments, such as gelatin or thyroid substance, can affect only the future nail since the lack of circulation in the mature appendage blocks access to the medication administered orally or parenterally. Iontophoresis has not proven efficacious in therapy of pathologic entities affecting the nails.

When subungual tumors or infections or hematomas exist, it is necessary to gain access to the area to apply the indicated therapeutic modality. Therefore it may be essential to remove the overlying nail or to produce a hole through it. While subungual warts and certain other tumors of this region may be treated with x-radiation, it may be necessary to remove the nail to perform a biopsy and receive histopathologic aid in establishing the diagnosis. Furthermore, many of the subungual tumors, such as melanomas and glomus tumors, are resistant to radiation therapy.

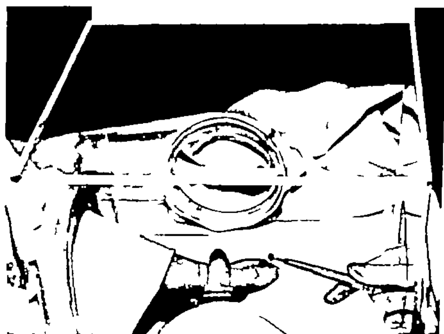
Surgical removal of the nail may be indicated also in some infections such as chronic paronychia and periungual granuloma pyogenicum.

Scraping of the Nails

In mycotic infections, either with fungi or monilia, the therapeutic problem is to find a potent fungicide that will penetrate into the depth of the appendage. Since such an agent is not available at the present time, every effort must be made to remove as much infected tissue as possible mechanically. One of the simpler procedures used to accomplish this is the scraping of the nails with a dull scalpel, or with the broken edge of a piece of glass, or with a file or with sandpaper. This is a time consuming procedure, although the patient can be taught to perform it himself. It is necessary in order to obtain the best results to have a cooperative patient who is willing to spend long periods of time at this arduous task for the nail should be scraped daily to a paper thin consistency. It is of value in those patients unavailable for the more radical procedures of grinding or onychectomy. The latter accomplish the removal of the diseased tissue much more quickly, surely and neatly.

The procedure requires little manual dexterity The patient must be warned not to damage the periungual or subungual tissue After the scraping is completed a fungicide should be applied daily to the nail Ointments are preferrable and these should be rubbed into the nail as thoroughly as possible

It should be remembered that scraping is a valuable adjunct in the treatment of onychomycosis. It is not a treatment in itself



F 101 —Plastic box t protect operator and patient from infected m terial sc ttered by nail grinder (Courtes of Dr Leon Goldman.)

GRINDIN

The infected nail ma be ground with an electric drill to accomplish the same thing as scraping The ad antages of doing it with an electric tool are peed and con enience In addition since the treatment is administered actually by the ph sician he can be assured that it is being carried out properl Thi procedure eliminates the need for slow continu us scraping b the patient

Various h bl drill or flexible haft drill such as a dental drill or kin planing machine can be adapted to this work One essential feature is a foot rheostat to c ntrol the peed of the drill

The grinding i lone without anesthesia unles the nail bed i to be ground als Th infected nail can be destro ed and the underlying amorphous infected material can be removed without discomf rt to the patient If the treatment i t so long the drill will become hot and cause som pain Thi however can be av ided b frequent short rest peri d

The bur (and there are various sized ones available) is laid parallel to the nail. Rotation is started by pressure with the operator's foot on the rheostat. *The speed is judged and controlled by the surgeon.* The infected, crumbling nail is easily removed in this manner. The same is true of the material that has formed under the nail. Harder nails require more pressure and greater speed. An attempt is made to remove as much as possible of the infected nail during the treatment. Repeated grindings are necessary in most instances because as the new nail grows out, it often shows evidence of infection. There is no objection to having the patient do as much scraping at home as his degree of cooperation allows as an adjunct to the grinding. Fungicidal therapy is still essential.

When the nail is ground, small pieces of nail are strewn over the immediate area. It lodges on the operator, patient, nurse, floor, etc. Since this material is potentially infectious, it is wise to put a transparent plastic shield over the hand and drill as recommended by Goldman. This is a three-sided box of sufficient size to allow for freedom of movement. The patient puts his hand in the box through an aperture at one end. The grinder and the surgeon's hand enter from the other side. The procedure is then performed "under glass," so to speak.

With a dental bur held at right angles to the nail, a hole can be drilled through the nail to empty a subungual hemorrhage or to allow access to open an infection. Such a hole can be produced with a hand drill but this has obvious disadvantages over the electric type. An actual cautery with a needle tip can be used for the same purpose.

REMOVAL OF PERIUNGUAL GRANULOMA PYOGENICUM

At times, a tumor of granulation tissue forms along the side of the nail. This may be due to infection or to irritation from an ingrowing nail. This may be resistant to conservative therapy and may require surgical intervention. If systemic antibiotic therapy (penicillin is recommended for this condition) and cutting away of the irritating portion of the nail fails to cure the condition, the neoplasm can be removed by electrodesiccation and curettage under local anesthesia.

ONYCHECTOMY

Indications.—Onychectomy refers to the surgical removal of a diseased or deformed nail or a nail whose presence complicates access to a pathologic condition under it. Therefore onychectomy is performed for nails infected with fungi or monilia. This is probably the prime indication. Nails that are deformed will regrow at times in a normal manner after removal of the abnormal appendage. This is true following trauma and in such conditions as onychogryphosis.

It is doubtful that nail grafting is necessary or desirable in these cases. This procedure requires the removal of two nails instead of one. It does not decrease the time necessary for regrowth of the nail. Briefly, the same nail on the other hand or foot, if normal, is grafted into the area from which the diseased or deformed nail has been removed.

At times it is necessary to avulse the nail to reach a subungual tumor such as a melanoma, a glomus tumor or a wart. Periungual verrucae often

extend far under the nail much further than one would surmise from simple inspection. Relief of pressure in a subungual infection or a hemorrhage might dictate the necessity of performing this operation.

Chronic paronychia in some instances, requires this treatment In fact if it were not for patient resistance to the idea of having his nails pulled out it would be the treatment of choice in cases not responding with reasonable rapidity to local and radiation therapy

Complete or partial onychectomy is the treatment of choice in ingrowing toenails. This can be accomplished best in most instances by making an incision over the nail fold and dissecting the skin off the underlying nail A longitudinal section about 25 per cent of the width of the nail is then cut back to the end of the matrix. This portion is then pulled out with a hemostat The wound is left open except for a dressing to control bleeding during the first twenty-four hours. Systemic antibiotic therapy may be necessary post-operatively The nail is expected to grow normally after this procedure

Technique —If a single nail is to be removed local anesthesia is preferred In cases in which ten or more nails are to be avulsed in a single session general anesthesia especially pentothal administered under hospital supervision is recommended Anesthesia for the removal of nails in numbers ranging from two to nine must be decided by the speed of the operator his judgment and the temperament of the patient. The removal of fingernail and of toenails does not differ from the technical standpoint

Pre-operative sedation with barbitals is advisable in apprehensive patients. Isopropyl alcohol, zephiran or a mercurial (metaphen or merthiolate) may be used as a pre-operative antiseptic Local anesthesia may be secured with 2 per cent procaine 1 per cent cyclaine or xylocaine or whatever agent is preferred by the operator This is administered intradermally and subcutaneously completely around the sides and proximal portion of the nail A rubber band is placed around the base of the digit to act as a tourniquet for hemostasis.

A small incision is made at each of the proximal corners of the paronychial tissue This is extended to the depth of the nail A hemostat is then slipped under the free distal end of the nail on one side This is pushed toward the base of the nail as far as it will go without undue pressure or pain The hemostat is then rotated toward the opposite edge of the nail In doing this, the nail is torn from the matrix. When the tear extends completely across the nail the distal portion may be removed The nail should be removed to the edge of the nail fold laterally and proximally It has been reported that 1 cc of hyaluronidase (100 turbidity units) injected under the distal portion of the nail facilitates its removal All small pieces should be picked out with a hemostat to prevent retained portion of the nail from acting as a foreign body and inspiring inflammatory or granulomatous changes All subungual material should be removed At times this can be scraped out easily with a dull curet However more commonly it is necessary to shave the hard material off until a normal bleeding surface remains.

The area should be dressed with petrolatum gauze or with boric acid ointment This should be changed as necessary After a few days, dressings

are no longer necessary since the oozing of blood ceases. At this time the area may be left uncovered. In the case of onychomycosis, strong fungicides, such as half to full strength Whitfield's ointment, may be applied twice a day without the expectation of a dermatitis. Post-operative pain and tenderness disappears as a rule within a few days.

Within three to six weeks a new nail makes its appearance proximally. After about three months it reaches the end of the finger. The first nail is often deformed and ridged. However, it soon regains its normal appearance. Removal of the matrix to produce permanent removal of the nails is seldom necessary or advisable. When this is done, however, the nail bed becomes hardened and thickened and acts as a nail.

Results.—The prognosis following onychectomy varies with the condition treated. It is successful in most chronic cases of paronychia. In onychomycosis, about 50 to 70 per cent of the nails regrow normally if fungicides are used while the nail is growing. Reinfection is common because of the persistence of infection in other untreated nails or in the skin. Therefore all infected nails should be treated at the same time. Every effort should be made to cure the mycotic infection of the skin prior to avulsing the nails. However, in many instances, the cutaneous involvement is of the chronic, hyperkeratotic resistant type. Strong fungicides such as full-strength Whitfield's ointment, asterol, etc., eradicate the infection of the skin in only a small percentage of cases and only after prolonged application. At times, saturated solution of potassium iodide in doses up to 100 drops three times a day or even larger amounts, is beneficial in such cases.

In deformities of the nail, the eventual outcome is dictated by the correction of the causative factors such as tight shoes, poor hygiene, etc. If the deformity followed a traumatic experience, the result will depend on the condition of the matrix. In other words, if the root of the nail is normal, usually the regrowth will be normal. However, if part of the matrix has been destroyed by the injury, the new nail will appear abnormal.

The procedure is not particularly painful. The patient can usually resume his normal occupation within a few days. The nails are shed in many conditions, a spontaneous onychectomy, and then regrow in a normal manner. Onychectomy is followed in many instances by a similar course. It is a worthwhile procedure that is not as radical as it sounds and is of therapeutic benefit in many conditions.

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